Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway
San Diego, California 92132-5190

Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FINAL
TIME-CRITICAL REMOVAL ACTION CLOSEOUT REPORT FOR IR SITE 1 OUTFALLS 9–15, SHORELINE SEDIMENTS NAVAL AIR STATION NORTH ISLAND CORONADO, CALIFORNIA

CTO-0148/0296
April 2002

Prepared by:

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CERTIFICATION

I certify that the information contained in or accompanying this submittal is true, accurate, and complete. As to those portions of this submittal for which I cannot personally verify the accuracy, I certify that this submittal and all attachments were prepared at my direction in accordance with procedures designed to assure that qualified personnel properly gathered and evaluated the information submitted. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: William E. Collins

Name: William E. Collins

Document Title: Final Time-Critical Removal Action Closeout Report for
IR Site 1 Outfalls 9–15, Shoreline Sediments
Naval Air Station North Island
Coronado, California
CTO-0148/0296

Date: 4/8/2002

SUMMARY

This Closeout Report summarizes the activities conducted for the Time-Critical Removal Action (TCRA) performed at Installation Restoration (IR) Site 1, Outfalls 9–15, shoreline sediments, Naval Air Station North Island.

This TCRA was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act. In addition, this TCRA complied with provisions for the conduct of interim measures as outlined in the State Hazardous Waste Facility Permit United States Environmental Protection Agency (U.S. EPA) ID Number CA 7170090016 of 21 December 1989, issued by the California Department of Health Services Toxic Substances Control Program (now known as the Department of Toxic Substances Control [DTSC]). Site activities were conducted by Nova Construction for the Southwest Division Naval Facilities Engineering Command under Military Construction Project P-549. This TCRA was conducted in accordance with the Action Memorandum (SWDIV 1995) and in cooperation with DTSC and the California Regional Water Quality Control Board (RWQCB) San Diego Region.

The removal action for Site 1 was performed to reduce the possibility that ecological and human receptors would be exposed to contaminants present in shoreline sediments in the current industrial scenario.

The TCRA took advantage of the military construction project associated with the planned homeporting of one Nimitz-class aircraft carrier (DON 1995a). This construction project included dredging the turning basin and constructing a 13.4-acre fill area behind a rock dike. The dredged-fill sediment, identified as unsuitable for ocean disposal, was placed over *in situ* Site 1 sediment. Ten to 14 feet of clean fill was placed over the dredged-fill sediment (SWDIV 1995). The clean fill was also used to create the 50-foot buffer zone between the dredged-fill sediments and the rock dike. The area was capped with asphalt or concrete. Construction of the rock dike and fill area (now known as the confined disposal facility [CDF]) was designed to enclose the *in situ* Site 1 sediment and the dredged-fill sediment, thus preventing direct human and ecological contact and reducing the potential risk presented by metals and semivolatile organic compounds in the sediment.

No permits were required for this TCRA; however, dredging and disposal permits from the United States Army Corps of Engineers (USACE) and U.S. EPA were obtained for the dredge and fill activities associated with Military Construction Project P-549. Dredging and construction activities were conducted in accordance with permit specifications to control turbidity and water column contaminants. There were no instances of noncompliance during removal or placement of the material within the CDF (Moffatt & Nichol Engineers 1999).

The TCRA was completed in 1998 in accordance with the Action Memorandum (SWDIV 1995). The objective of the TCRA, to reduce the possibility that ecological and human receptors could be exposed to contaminants present in shoreline sediments in the current industrial scenario, was met.

However, both RWQCB Order No. 95-118 and USACE Permit No. 94-20861-DZ, obtained for the associated dredge and fill activities, required that a water quality program be instituted to monitor the concentrations and solubility of the chemicals of concern in the dredged-fill material and to confirm whether the CDF effectively prevents migration of contaminants into San Diego

Bay or groundwater sources. A plan for postclosure maintenance of the quaywall site was also required.

The Nearshore CDF Postdredge Monitoring Plan (Moffatt & Nichol Engineers 1999), issued in February 1999, meets the postclosure monitoring plan requirements set forth in the RWQCB and USACE permits. The California Coastal Commission approved the Nearshore CDF Postdredge Monitoring Plan in August 1999. In addition, a final focused Remedial Investigation (RI)/ Resource Conservation and Recovery Act Facility Investigation (RFI) Work Plan for IR Site 1, Outfalls 9–15, Shoreline Sediments, was issued in 1998 (BNI 1998).

Both the Nearshore CDF Post Dredge Monitoring Plan and the Focused RI/RFI Work Plan were developed and modified in accordance with regulatory comments from DTSC and RWQCB. The plans were also distributed to the potential stakeholders and made available to the Restoration Advisory Board for review and comment.

The Focused RI/RFI Work Plan describes the rationale proposed for the use of existing data, sample collection, and analytical methods to conduct a focused RI/RFI at Site 1, Outfalls 9–15. The objective of the focused RI/RFI is to evaluate potential risks to human health and/or the environment posed by the *in situ* Site 1 sediments and the dredged-fill sediments within the CDF and to confirm the effectiveness of the CDF as a final remedial solution. The RI/RFI is a focused investigation because the scope is limited to confirming the effectiveness of the selected remedy, the CDF, as implemented. The focused RI/RFI is scheduled for completion in 2003.

The feasibility study (FS)/corrective measures study (CMS) will assess the need for additional remedies at Site 1 on the basis of the findings of the focused RI/RFI. The FS/CMS is scheduled for completion in 2006.

ACRONYMS/ABBREVIATIONS

alpha-BHC	alpha isomer of benzene hexachloride
ARAR	applicable or relevant and appropriate requirement
beta-BHC	beta isomer of benzene hexachloride
bgs	below ground surface
BNI	Bechtel National, Inc.
CCR	*California Code of Regulations*
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CMS	corrective measures study
COC	chemical of concern
CWA	Clean Water Act
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
delta-BHC	delta isomer of benzene hexachloride
DHS	Department of Health Services
DON	Department of the Navy
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
ERL	effects-range low
ERM	effects-range median
FS	feasibility study
gamma-BHC	gamma isomer of benzene hexachloride
HLA	Harding Lawson and Associates
IAS	initial assessment study
IR	Installation Restoration (Program)
JEG	Jacobs Engineering Group Inc.
LPC	limiting permissible concentration
µg/kg	micrograms per kilogram
µg/L	micrograms per liter

MEC	MEC Analytical Systems, Inc.
mg/kg	milligram per kilogram
MLLW	mean lower low water
NAS	Naval Air Station
NEESA	Naval Energy and Environmental Support Activity
NWQO	numerical water quality objective
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RI	remedial investigation
RWQCB	(California) Regional Water Quality Control Board
SPLP	synthetic precipitation leaching procedure
STLC	solubility threshold limit concentration
SVOC	semivolatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
SWMU	solid waste management unit
SWRCB	(California) State Water Resources Control Board
TCRA	time-critical removal action
TOH	total organic halides
TRPH	total recoverable petroleum hydrocarbons
TTLC	total threshold limit concentration
USACE	United States Army Corps of Engineers
USC	*United States Code*
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
VS	verification study
WCC	Woodward-Clyde Consultants

Section 1
INTRODUCTION

This Closeout Report summarizes the activities conducted for the Time-Critical Removal Action (TCRA) performed at Installation Restoration (IR) Site 1, Outfalls 9–15, shoreline sediments, Naval Air Station (NAS) North Island.

This TCRA was conducted in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In addition, this TCRA complied with provisions for the conduct of interim measures as outlined in the State Hazardous Waste Facility Permit United States Environmental Protection Agency (U.S. EPA) ID Number CA 7170090016 of 21 December 1989, issued by the California Department of Health Services Toxic Substances Control Program (now known as the Department of Toxic Substances Control [DTSC]). Site activities were conducted by Nova Construction for the United States Department of the Navy (DON), Southwest Division Naval Facilities Engineering Command (SWDIV), under Military Construction Project P-549. This TCRA was conducted in accordance with the Action Memorandum (SWDIV 1995) and in cooperation with DTSC and the California Regional Water Quality Control Board (RWQCB) San Diego Region.

This report has been prepared by Bechtel National, Inc., under Contract Task Order 0148 of the Comprehensive Long-Term Environmental Action Navy II Program, Contract No. 68711-92-D-4670, for SWDIV.

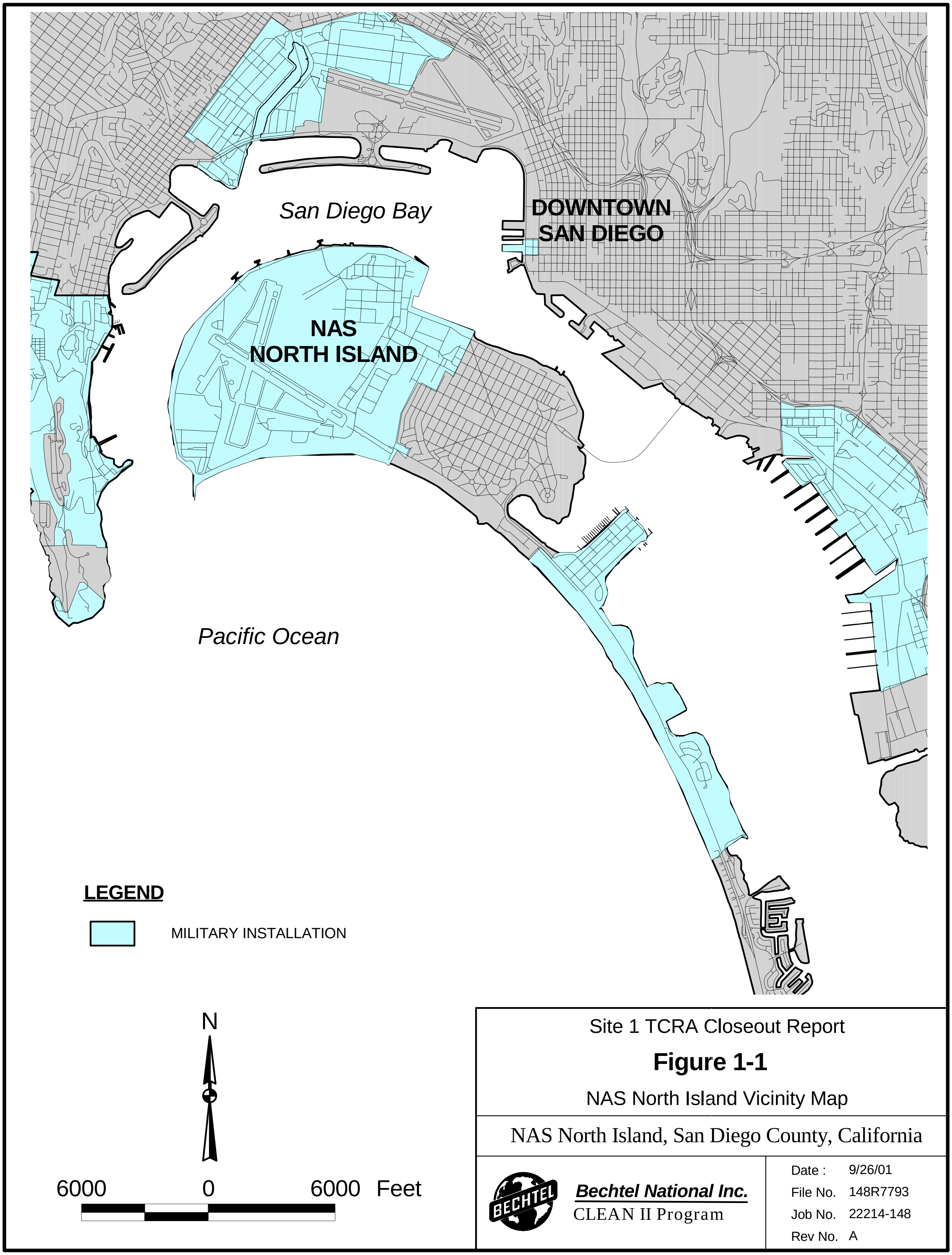
1.1 FACILITY LOCATION AND DESCRIPTION

NAS North Island is located in San Diego County, California, in the cities of San Diego and Coronado. NAS North Island is located on the northern end of the Silver Strand peninsula that separates San Diego Bay from the Pacific Ocean, and it is bordered by the city of Coronado to the east, the Pacific Ocean to the south, San Diego Bay to the north, and the inlet to San Diego Bay to the west (Figure 1-1). The San Diego downtown area, approximately 1 mile across San Diego Bay from NAS North Island, has a population exceeding 1 million people. Coronado has a population of approximately 27,000 and approximately 15,000 additional nonresidential military personnel.

IR Site 1, Outfalls 9–15, shoreline sediments, is located in the northeastern portion of NAS North Island (Figure 1-2) and is owned and managed by the DON. Activities at this site are consistent with ongoing naval activities at NAS North Island. Overall land use at NAS North Island is considered to be industrial.

1.2 SITE HISTORY

In 1983, Brown and Caldwell, Inc., conducted an initial assessment study (IAS) of the Site 1 shoreline sediments for the Naval Energy and Environmental Support Activity (NEESA). The IAS Report concluded that industrial wastes were historically discharged into San Diego Bay and the Pacific Ocean through storm drain Outfalls 1–16 (Figure 1-3). This practice ended in the mid-1970s with the connection of all waste sources to an industrial-waste treatment system (Brown and Caldwell 1983). The IAS Report recommended a confirmation study for Site 1 and designated it as an IR site.



Site 1 TCRA Closeout Report

Figure 1-1

NAS North Island Vicinity Map

NAS North Island, San Diego County, California

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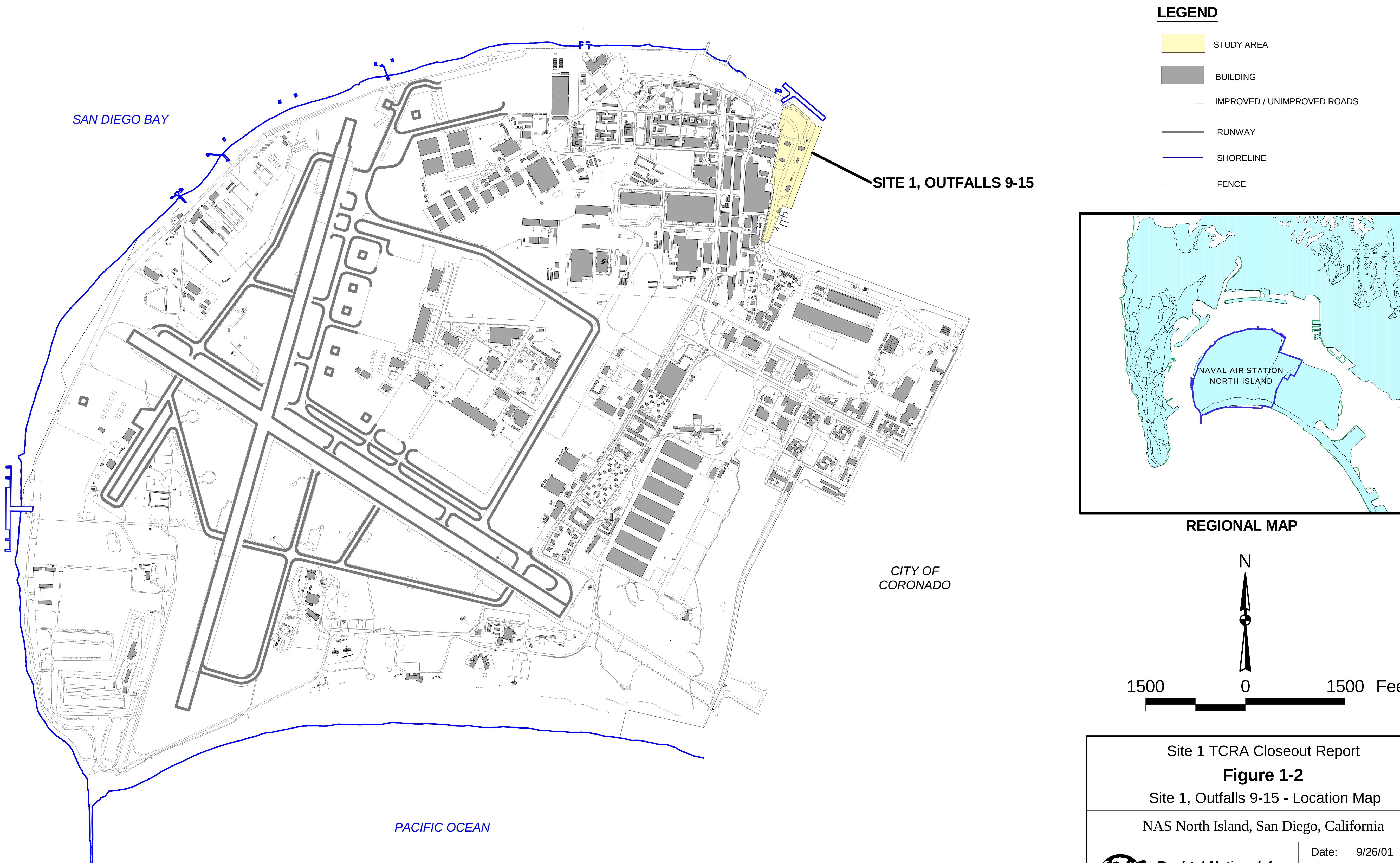
CLEAN II Program

Date :	9/26/01
File No.	148R7793
Job No.	22214-148
Rev No.	A



Site 1 TCRA Closeout Report

Figure 1-2

Site 1, Outfalls 9-15 - Location Map

NAS North Island, San Diego, California

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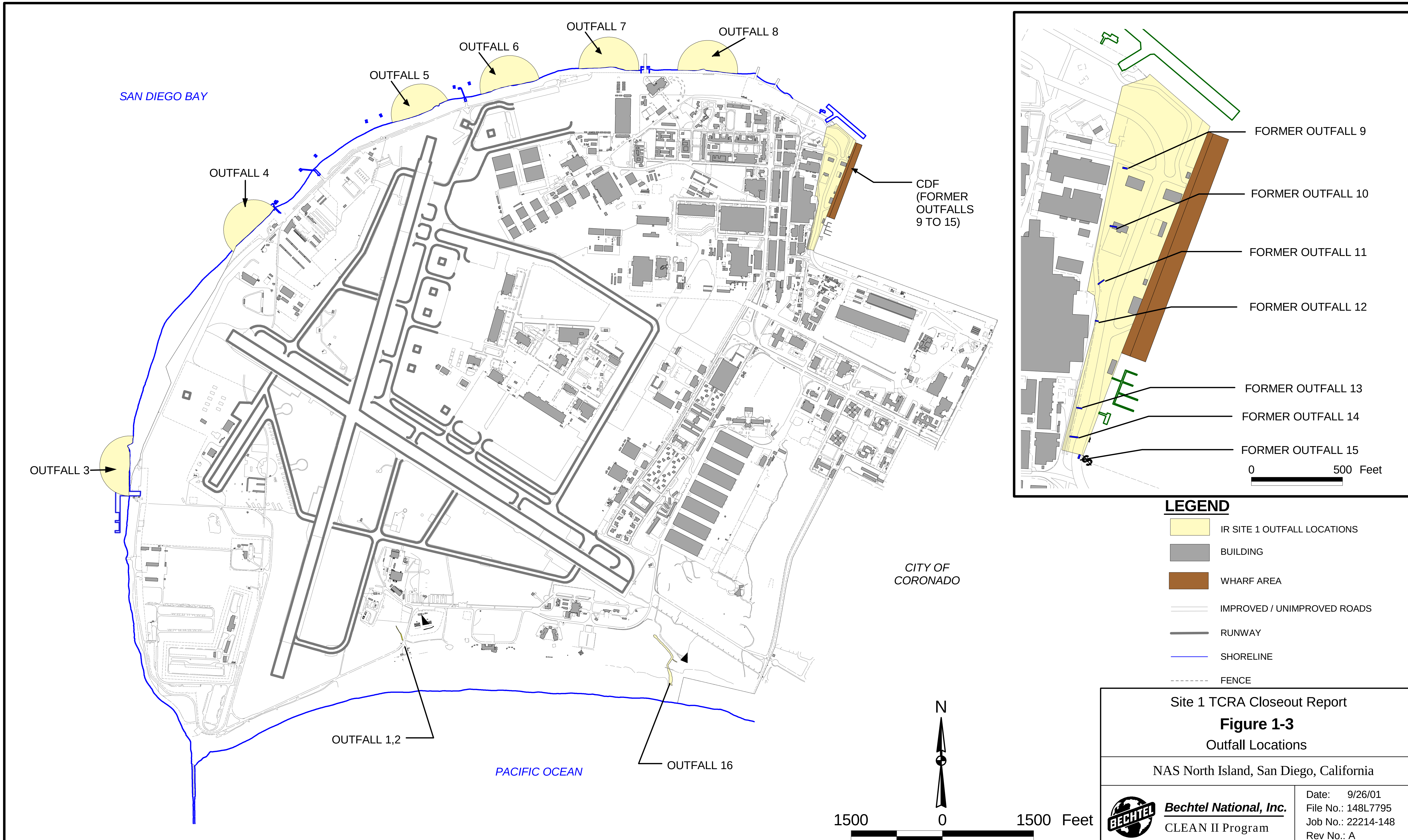
Rev No.: A


SAN DIEGO BAY
OUTFALL 3
OUTFALL 4
OUTFALL 5
OUTFALL 6
OUTFALL 7
OUTFALL 8
CDF (FORMER OUTFALLS 9 TO 15)
CITY OF CORONADO
OUTFALL 1,2
OUTFALL 16
PACIFIC OCEAN
FORMER OUTFALL 9
FORMER OUTFALL 10
FORMER OUTFALL 11
FORMER OUTFALL 12
FORMER OUTFALL 13
FORMER OUTFALL 14
FORMER OUTFALL 15
0 500 Feet
LEGEND
IR SITE 1 OUTFALL LOCATIONS
BUILDING
WHARF AREA
IMPROVED / UNIMPROVED ROADS
RUNWAY
SHORELINE
FENCE
N
1500 0 1500 Feet
Site 1 TCRA Closeout Report
Figure 1-3
Outfall Locations
NAS North Island, San Diego, California
Bechtel National, Inc.
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Date: 9/26/01
File No.: 148L7795
Job No.: 22214-148
Rev No.: A

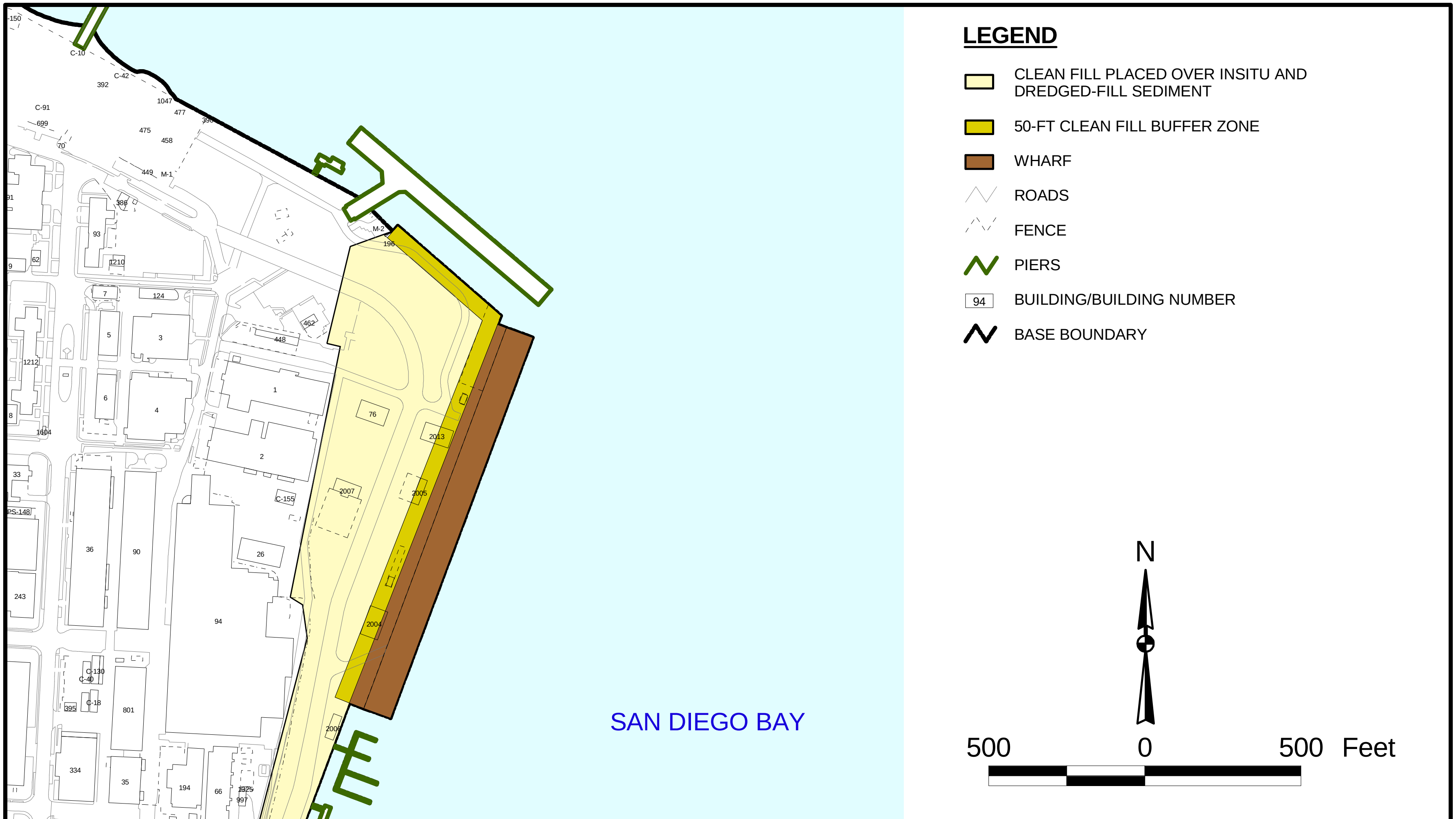
It is estimated that approximately 350 million gallons of industrial wastes went through the NAS North Island outfalls annually between 1917 and 1972 (Brown and Caldwell 1983). Approximately 27 percent (96 million gallons) of the annual discharge went through Outfalls 9–15. The wastes discharged between 1917 and 1972 included 70 tons of heavy metals of which an estimated 80 percent went equally through Outfalls 5 and 11 (Brown and Caldwell 1983). These wastes were primarily generated by facilities dedicated to the maintenance and repair of aircraft. Wastes included metals, solvents, alkaline and acid cleaning residues, plating solutions, cyanide wastes, paint, paint removal sludge, and petroleum products (Brown and Caldwell 1983).

The Resource Conservation and Recovery Act (RCRA) facility assessment conducted in 1989 by the California Department of Health Services Toxic Substances Control Program identified 81 solid waste management units (SWMUs) and 3 areas of concern at NAS North Island (DHS 1989). Corrective actions included conducting RCRA facility investigations (RFIs) for SWMUs such as SWMU No. 1 (IR Site 1). The wastes listed for SWMU No. 1 included petroleum products, solvents, acid and alkaline cleaning residues, metals, plating solutions, cyanide wastes, paint and paint removal sludges, sanitary sewage, and other miscellaneous cleaning chemicals (DHS 1989).

In 1993, Congress directed the DON to close NAS Alameda and relocate ships homeported there to San Diego and the Pacific Northwest as part of the Base Closure and Realignment Act. Affected ships included one Nimitz-class aircraft carrier, which relocated to NAS North Island in 1998.

To homeport and maintain one Nimitz-class aircraft carrier at NAS North Island, extensive dredging was required of the turning basin and approach and the San Diego Bay navigational channel. Before issuance of the dredging and disposal permits, the United States Army Corps of Engineers (USACE) and U.S. EPA required extensive chemical, physical, and biological testing to assess the quality of the proposed dredge material and identify acceptable sediment disposal options. Identified disposal options included beach replenishment, ocean disposal, and containment within a rock dike structure. The testing conducted at Site 1 is summarized in Section 2 of this report, Previous Investigations.

In 1995, the DON issued an Action Memorandum for a TCRA of Site 1, Outfalls 9–15, Shoreline Sediments (SWDIV 1995). The chosen alternative took advantage of military construction associated with the homeporting of the Nimitz-class aircraft carrier. The construction project included dredging the turning basin and approach and constructing a 13.4-acre fill area behind a rock dike (Figure 1-4).



Site 1 TCRA Closeout Report

Figure 1-4

Confined Disposal Facility (CDF) and Surroundings

NAS North Island, San Diego, California

Bechtel National, Inc.
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Date: 9/26/01
File No.: 148L7796
Job No.: 22214-148
Rev No.: A

The dredged-fill sediments from the turning basin, identified as unsuitable for ocean disposal on the basis of testing results, were placed over the *in situ* Site 1 sediments and behind the rock dike. Ten to 14 feet of clean fill was placed over the *in situ* and dredged-fill sediments and capped with asphalt or concrete. The clean fill was also used to create the 50-foot buffer zone between the dredged-fill sediments and the rock dike. The rock dike and fill area (now known as the Confined Disposal Facility [CDF]) enclosed the *in situ* Site 1 sediment and the dredged-fill sediment, thus preventing direct human and ecological contact (SWDIV 1995).

1.3 PHYSICAL SETTING

This section describes the site physical conditions and biological features. The primary sources of the information presented in this section are the IAS Report (Brown and Caldwell 1983), the draft Remedial Investigation (RI) Report (HLA 1989), and the NAS North Island Sites 1, 5, 6, 9, and 10 draft Sampling and Analysis Plan (JEG 1991).

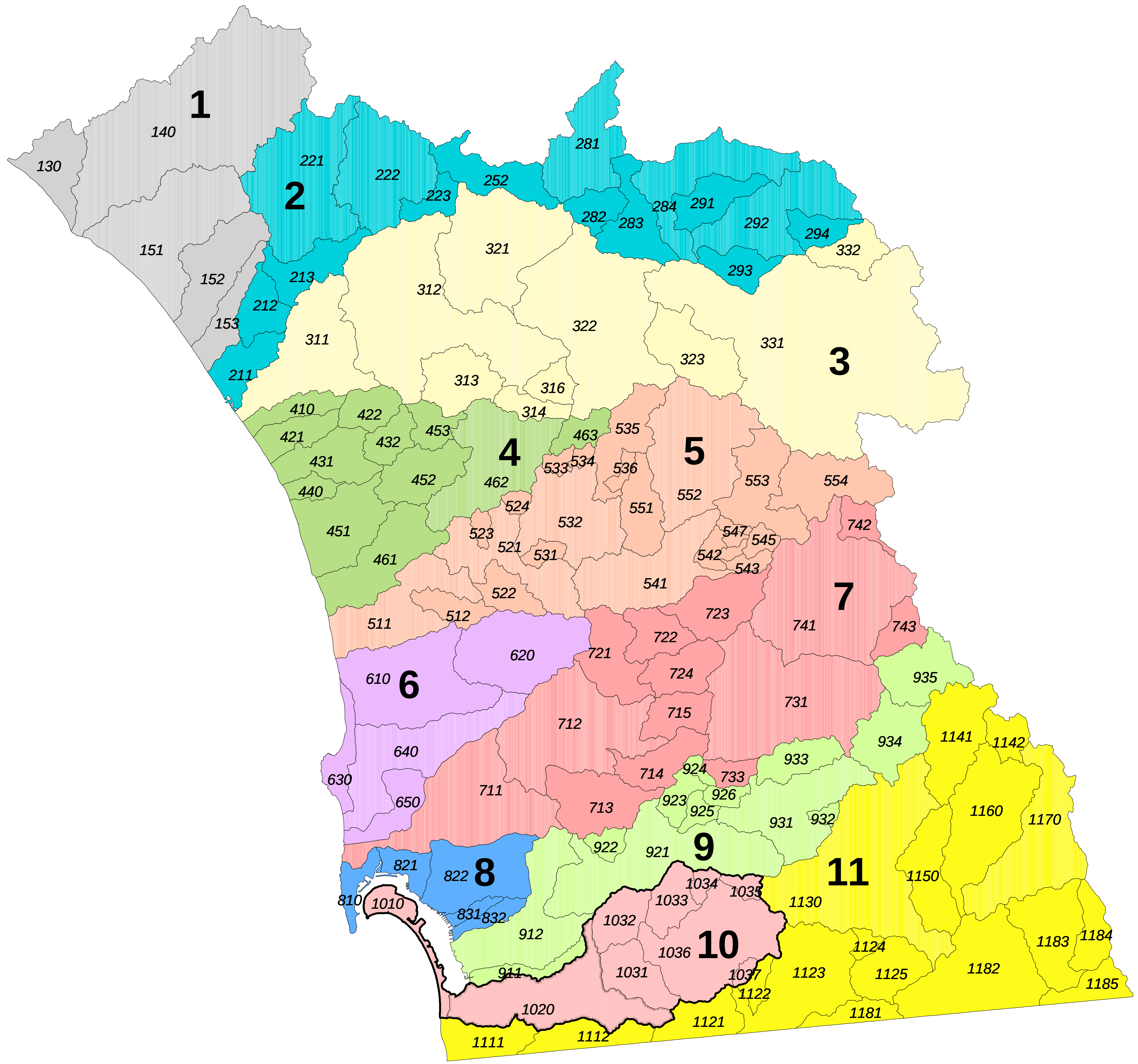
1.3.1 Climate and Hydrology

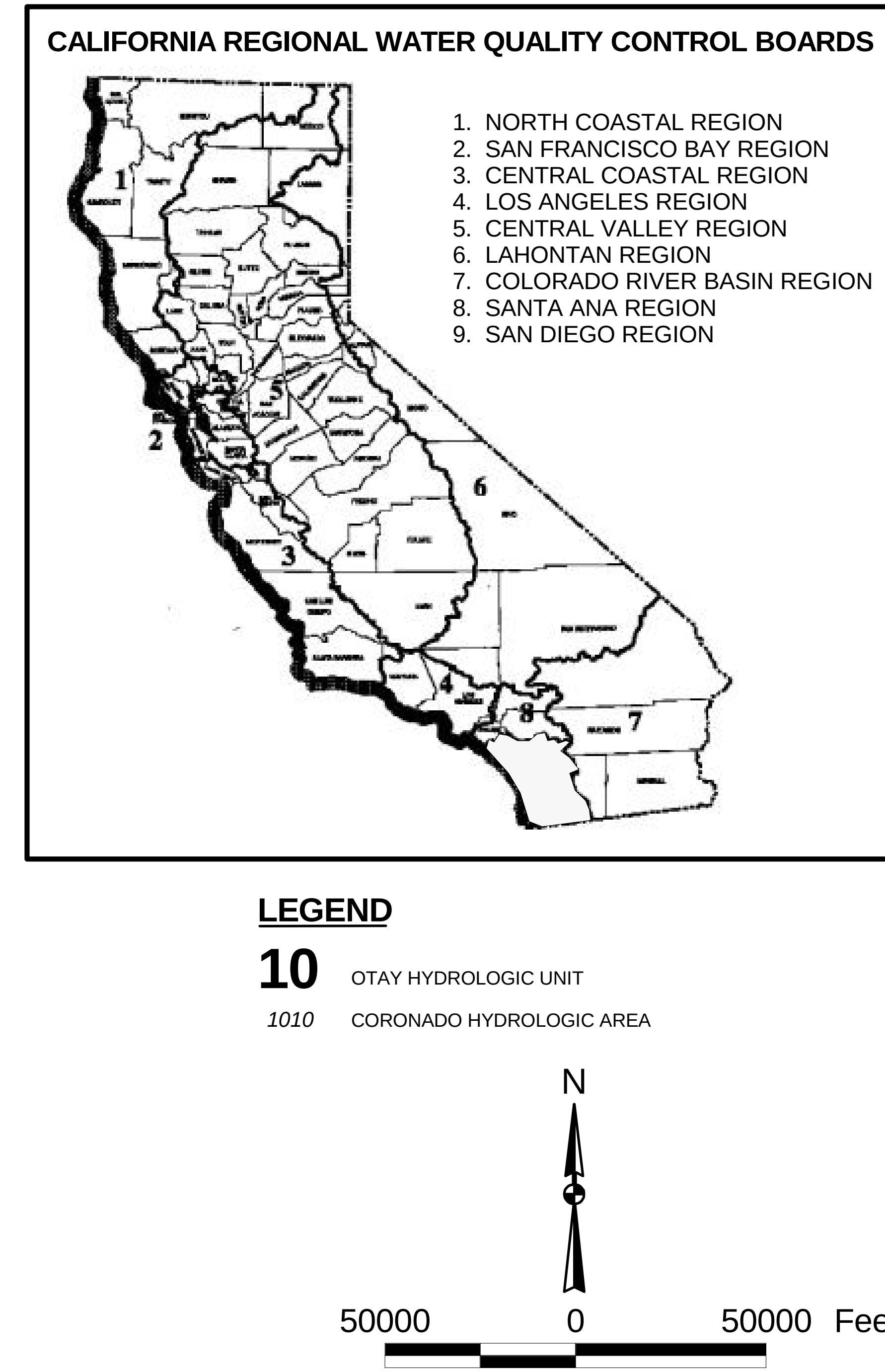
The climate on NAS North Island is mild and semiarid, tempered by cool sea breezes. The average annual precipitation in the area is about 10 inches per year and can vary greatly from year to year. The precipitation occurs mostly in winter as cold fronts and troughs pass through the area.

Prevailing winds in the southern California coastal region are from the west-northwest. Velocities are generally highest in the afternoon, averaging 15 miles per hour. During “Santa Ana” conditions, warm winds up to about 30 miles per hour blow from the east. Winds up to 60 miles per hour have been recorded on rare occasions (Brown and Caldwell 1983).

There are no natural streams or bodies of water on NAS North Island, but the base is bordered by the Pacific Ocean and the San Diego Bay. Because of the general lack of relief and the small size of the island, there is no pronounced surface drainage pattern. Two sloughs along the southern coastline are the only identifiable natural surface drainages on NAS North Island. Most of the surface runoff is collected by storm sewers and discharged directly into the Pacific Ocean or San Diego Bay. The maximum depth of San Diego Bay is 50 feet at the center of the shipping channel, which is maintained by dredging. The bay is 0.25 to 2.5 miles wide and covers approximately 18 square miles. On the Pacific Ocean side, wave action and the long shore current result in beach deposits.

According to the Water Quality Control Plan for the San Diego Basin (Region 9), NAS North Island lies within the Coronado hydrologic area of the Otay hydrologic unit (Figure 1-5) (RWQCB 1994). The coastal waters of San Diego Bay and the Pacific Ocean have beneficial uses, including water contact recreation and marine habitat. Marine fisheries and designated fishing grounds are not present in the bay.





Site 1 TCRA Closeout Report

Figure 1-5

San Diego Basin Hydrologic Units and Areas

NAS North Island, San Diego, California

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Date: 10/4/01
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Job No.: 22214-148
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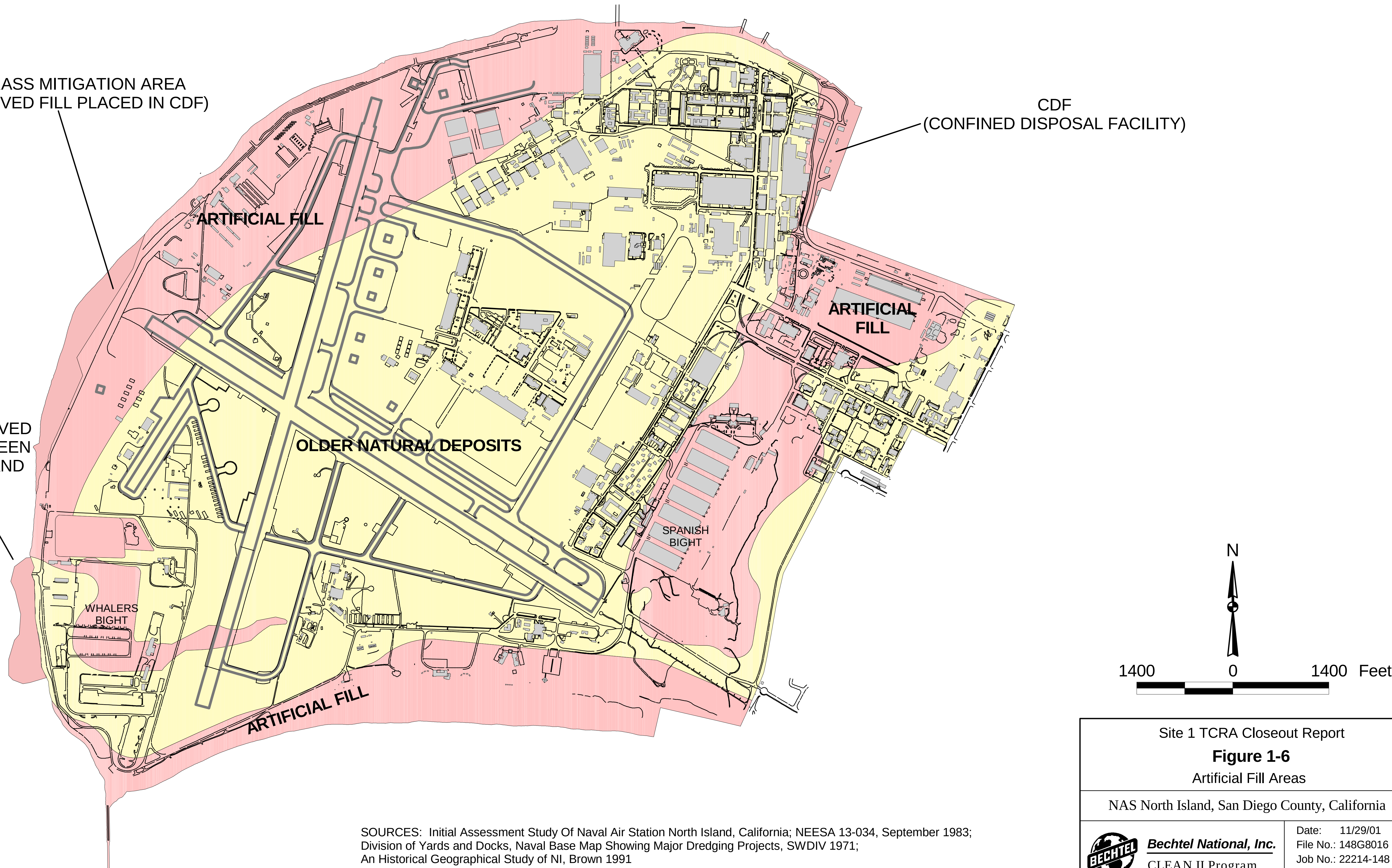
1.3.2 Geological and Hydrogeological Conditions

The shape and size of NAS North Island have been modified considerably, primarily as a result of adding artificial fill derived from the dredging of San Diego Bay from the 1930s to the 1950s. Fill was added to four areas that were previously tidal flats or were covered by shallow water (JEG 1991). The four areas, shown in Figure 1-6, are the Whalers Bight, the Spanish Bight, and former tidelands on the northwestern and southern shores of NAS North Island.

Geologic units exposed on NAS North Island or encountered in borings are limited to artificial fill and the Quaternary Bay Point Formation. The artificial fill is primarily hydraulic fill consisting of medium- to coarse-grained, poorly graded, silty sands. In some areas, the fill is underlain by bay floor mud consisting of organic silts and clay 5 to 7 feet thick. On NAS North Island, the Bay Point Formation consists of thick sands, silts, and clays. The southern margin of the base is covered by recent beach deposits composed of unconsolidated sand and silt.

The San Diego Bay floor sediments near northeastern NAS North Island are primarily composed of brown to gray, poorly graded, fine-to-medium grained sand and contain mostly seashell fragments with a moderate-to-strong sulfurous odor (HLA 1989). San Diego Bay and NAS North Island are underlain by northeast-oriented faults, including the Old Town Fault, the Coronado fault, the Spanish Bight fault, and a series of faults offshore of San Diego. A marine geophysical survey performed by Woodward-Clyde Consultants in 1994 confirmed that the Spanish Bight fault, a splay of the Rose Canyon fault zone, projects through the project site. The report also recommended that the fault be considered active (WCC 1994a,b). Regional geology is presented in more detail in the IAS Report (Brown and Caldwell 1983), the draft RI Report (HLA 1989), and the Sampling and Analysis Plan (JEG 1991).

Groundwater beneath NAS North Island generally exists under unconfined conditions. The water table is shallow, varying from approximately 25 feet below ground surface (bgs) near the center of NAS North Island to approximately 4 feet bgs near the southeastern shore (JEG 1991). The groundwater elevations suggest a water table with a very slight gradient of 0.0004 to 0.0007 directed radially out from the golf course (BNI 1995). Recharge at NAS North Island is primarily from golf course irrigation. A generally applied hydrological model for NAS North Island is one used for islands within saltwater bodies (JEG 1991). The model depicts a lens-shaped body of freshwater floating isostatically atop the denser saltwater, because of the density difference between freshwater and saltwater. Further discussion of this hydrogeological model is presented in the Sampling and Analysis Plan (JEG 1991). Groundwater from NAS North Island discharges to San Diego Bay and the Pacific Ocean.



SOURCES: Initial Assessment Study Of Naval Air Station North Island, California; NEESA 13-034, September 1983; Division of Yards and Docks, Naval Base Map Showing Major Dredging Projects, SWDIV 1971; An Historical Geographical Study of NI, Brown 1991

Site 1 TCRA Closeout Report

Figure 1-6

Artificial Fill Areas

NAS North Island, San Diego County, California

Bechtel National, Inc.

CLEAN II Program

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The groundwater at the CDF is approximately 8 feet below ground surface at an elevation of approximately 4 feet above mean lower low water (MLLW). Groundwater flow at the CDF is from east to west toward San Diego Bay, except in the northernmost part of the CDF where flow is from south to north, also toward the bay (Huntley 1999). The groundwater gradient at the CDF is 0.002 through the fill area of the CDF and appears to steepen to 0.02 through the 50-foot-wide clean fill buffer (Huntley 1999).

1.3.3 Biological Setting

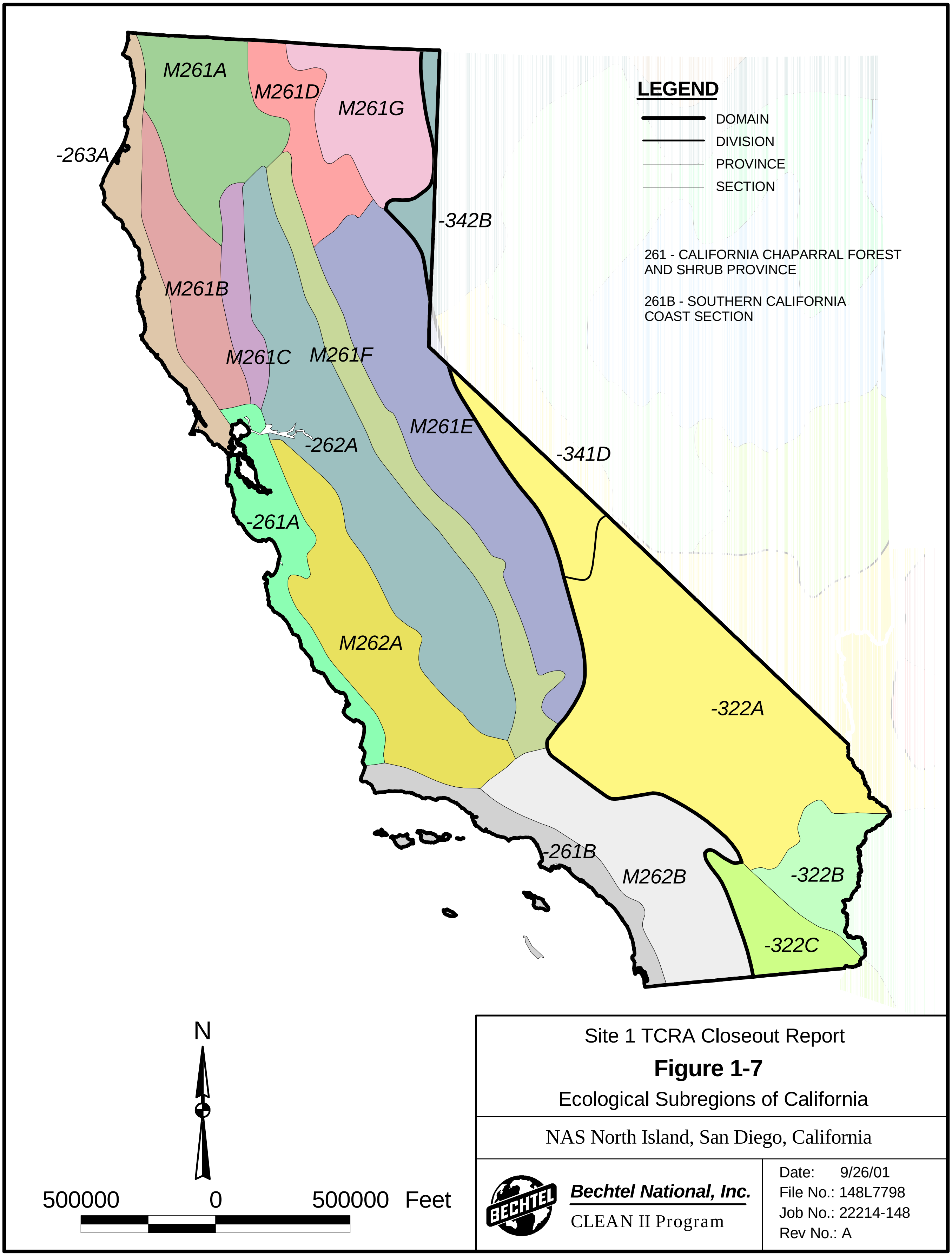
The ecoregion classification scheme used by the United States Department of Agriculture Forest Service identifies the San Diego area as part of the Southern California Coast Section within the California Coastal Chaparral Forest and Shrub Province (Figure 1-7) (USDA 1997). The coastal terrace subsection consists of dissected marine terraces from Newport Beach southeast to the Mexican border.

Generally, surface water runoff within the coastal terrace subsection is rapid, except from undissected terrace surfaces, which have vernal pools on them. Many streams that drain from the mountains across this subsection are perennial, but most of the lateral streams are dry though the summer. There are no lakes other than temporary ponding behind sandbars.

The predominant natural plant communities are California sagebrush–California buckwheat series and California sagebrush–black sage series. Torrey pine stands and San Diego mesa vernal pools in the southern part of the subsection are unique.

Mammals of the coastal terrace subsection include mule deer, coyotes, bobcat, fox, skunk, raccoon, opossum, and ground squirrel. Turkey vultures, hawks, jays, quail, owls, herons, egrets, flycatchers, swallows, and ravens are common birds. Birds of concern in the subsection include the brown pelican, lesser tern, osprey, black rail, clapper rail, California gnatcatcher, and Savannah sparrow. Reptiles and amphibians include the western rattlesnake, common garter snake, alligator lizards, and several species of salamanders and frogs. Marine and shore species include sea lions, seals, brown pelicans, gulls, cormorants, terns, and various shore birds.

Over 15 bird species reportedly nest at NAS North Island, including significant populations of black-crowned night heron, burrowing owl, western gulls, and the California least tern. The California least tern is a federal- and state-listed endangered species. The burrowing owl is a California species of special concern and a federal Category II candidate for listing as an endangered species. A large population of black-tailed jackrabbit also inhabits NAS North Island (Brown and Caldwell 1983). Additional ecological information for the San Diego Bay is located in the IAS Report (Brown and Caldwell 1983), the draft RI Report (HLA 1989), and the NAS North Island Sites 1, 5, 6, 9, and 10 draft Sampling and Analysis Plan (JEG 1991).



Site 1 TCRA Closeout Report

Figure 1-7

Ecological Subregions of California

NAS North Island, San Diego, California

Bechtel National, Inc.
CLEAN II Program

Date: 9/26/01
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The biological habitats near NAS North Island are diverse because of its location between the Pacific Ocean and the San Diego Bay. San Diego Bay, which includes about 600 acres of tidal mudflats and 350 acres of salt marsh, is the largest marine bay and estuary in southern California and provides important spawning and nursery habitat for marine fish and invertebrates. San Diego Bay is an integral element in the food web of adjacent ocean waters (Brown and Caldwell 1983). Numerous species of migrant and resident marine birds and shorebirds frequent the shoreline and some inland areas during various times of the year. The bay is also a stopover for migratory birds on the Pacific flyway.

Salt marsh habitat and intertidal flats (including mudflats, sandflats, and salt flats) are not present in the vicinity of the CDF or at NAS North Island. These habitats are present only in south San Diego Bay. The closest salt marsh habitat and intertidal flats are located in the vicinity of north and south delta beaches at Naval Amphibious Base Coronado (DON 1999).

Currently, there is no eelgrass habitat in the vicinity of the CDF. Before construction, intertidal and shallow tidal habitat, including 3.9 acres of eelgrass habitat, were present at the site. A 14-acre mitigation site was established on the western shore of NAS North Island to offset the loss of habitat (Figure 1-6) (DON 1995a).

A least tern nesting area is located at NAS North Island toward the center of the facility on a portion of the central airfield (BNI 2000). In addition, the western snowy plover winters on the southern shoreline of NAS North Island (BNI 2000). Neither of these areas is near the CDF.

Terrestrial habitat types have not been identified at the CDF because contact of sensitive biota with site contaminants is prevented by an asphalt and/or concrete cover.

1.4 REPORT ORGANIZATION

This report was prepared to facilitate the regulatory review process so that the site can proceed to closure in the most expeditious manner possible. It provides a summary of activities performed, observations made, and information identified during site activities and recommendations based on resultant data. The report is organized as follows.

- Section 1 describes the historical and physical setting of NAS North Island.
- Section 2 summarizes previous investigations.
- Section 3 summarizes the Action Memorandum.
- Section 4 discusses the permitting requirements and additional testing.
- Section 5 summarizes the construction activities.
- Section 6 presents conclusions.
- Section 7 contains the references to support the text.
- Appendix A presents the response to regulator comments on the draft TCRA Closeout Report.

Section 2
PREVIOUS INVESTIGATIONS

Previous investigations conducted at IR Site 1 included studies to characterize the extent of contamination in the sediments associated with Outfalls 9–15 as well as studies to support the homeporting dredging project and associated ocean disposal and beach replenishment. These investigations are summarized in the following text.

2.1 INITIAL ASSESSMENT STUDY

In 1983, Brown and Caldwell identified potential contamination of sediment at Site 1 during an IAS for NEESA. The IAS Report concluded that industrial wastes were historically discharged into the NAS North Island storm drain system, which emptied into surrounding marine waters (San Diego Bay) through storm drain outfalls. This practice ended in the mid-1970s with the connection of all waste sources to an industrial-waste treatment system (Brown and Caldwell 1983).

It is estimated that approximately 350 million gallons of industrial wastes flowed through the NAS North Island outfalls annually from 1917 through 1972 (Brown and Caldwell 1983). Approximately 27 percent (96 million gallons) of the annual discharge went through Outfalls 9–15. The wastes discharged between 1917 and 1972 included 70 tons of heavy metals of which an estimated 80 percent went equally through Outfalls 5 and 11 (Brown and Caldwell 1983). These wastes were primarily generated by facilities dedicated to the maintenance and repair of aircraft. Wastes include metals, solvents, acid, alkaline cleaning residues, plating solutions, cyanide wastes, paint, paint removal sludge, and petroleum products (Brown and Caldwell 1983).

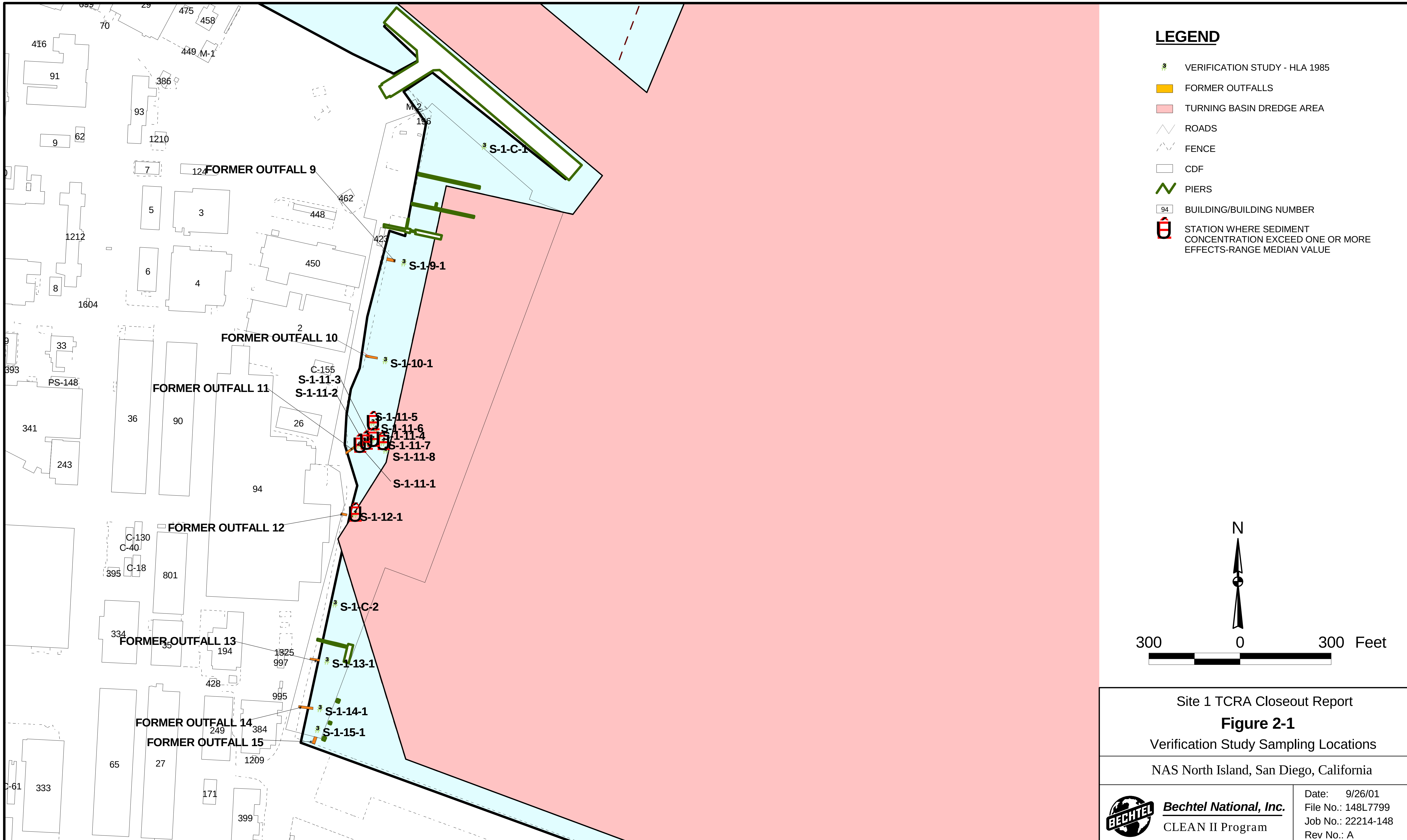
On the basis of past disposal of industrial wastes through the storm drain system, the IAS Report recommended a verification study (VS) for Site 1 and designated it as an IR site.

2.2 VERIFICATION STUDY

In 1985, Harding Lawson and Associates (HLA) performed a VS to investigate sediment in the immediate vicinity of Outfalls 9–15 (HLA 1985).

The VS included surface and near-surface sample locations to a maximum depth of 2.5 feet at Outfalls 9–15 and two background control points. The control point locations were assumed to be relatively uncontaminated by industrial wastes because they were not near outfalls. The VS sample locations are shown in Figure 2-1. The sediments, including the control point samples, were analyzed for cadmium, chromium, hexavalent chromium, copper, lead, nickel, silver, and zinc. Sediments from Outfalls 13 and 14 and one of the two control points were also analyzed for mercury.

In the VS Report, the results of the metal analyses were compared to soluble threshold limit concentration (STLC) and total threshold limit concentration (TTLC) values contained in the *California Code of Regulations* (CCR) Title 22. None of the sediments contained metals at concentrations that exceeded TTLC values. However, STLC values were exceeded for cadmium, copper, and lead at Outfalls 9, 11, 12, and 15.



Site 1 TCRA Closeout Report

Figure 2-1

Verification Study Sampling Locations

NAS North Island, San Diego, California

Because total concentrations of individual metals were between STLC and TTLC values, the VS Report recommended that a characterization study be conducted at Site 1, Outfalls 9–15.

Table 2-1 presents the metals results and the effects-range low (ERL) and effects-range median (ERM) values. The ERL and ERM values were developed by the National Oceanic and Atmospheric Administration after compilation and evaluation of sediment chemistry data, toxicity data, and results of field surveys in marine and estuarine sediments throughout the United States (Long et al. 1995). The analytical results indicate that ERM values for cadmium and chromium were exceeded in one or more sediment samples. The ERL and ERM values delineate three concentration ranges for each chemical. Concentrations below the ERL value represent a minimal-effects range within which toxic effects would not commonly be observed. Concentrations between the ERL and the ERM represent a possible-effects range within which toxic effects could occur more frequently. The third concentration range, above the ERM value, represents a probable-effects range within which toxic effects would be expected to frequently occur.

2.3 REMEDIAL INVESTIGATION

In 1988, HLA performed an RI at IR Site 1 that included the sediment near Outfalls 9–15. Sediment samples were collected from 38 vibracore locations to assess the extent of contaminants in sediments (HLA 1989). Sampling locations are shown in Figure 2-2. Sediment samples were analyzed for metals (listed in CCR Title 22), aromatic volatile organics, total organic halides (TOH), and total recoverable petroleum hydrocarbons (TRPH). Samples reported to contain TRPH were also analyzed for semivolatile organic compounds (SVOCs).

The sediment samples were reported to contain arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, thallium, vanadium, and zinc; petroleum hydrocarbons; and 11 priority pollutant polynuclear aromatic hydrocarbons (PAHs) (HLA 1989). Tables 2-2, 2-3, and 2-4 summarize the analytical results from the RI.

In the absence of clear regulatory guidelines for evaluating total metal concentration data for offshore sediments, state STLC and TTLC criteria were used in the RI to assess whether the sediment samples collected near Outfalls 9–15 would be classified as nonhazardous or hazardous if dredged and placed on land. Total metal concentrations reported in the sediment samples did not exceed their respective TTLC criteria. In lieu of performing a waste-extraction test on all samples that exceeded the STLC criteria, each total metal concentration was compared to the product of 10 times the STLC value. Because the maximum reported concentration for each metal was generally less than 10 times the STLC value, it would be considered nonhazardous. The exceptions were lead and cadmium, which did exceed 10 times the respective STLC values. On the basis of the results, the RI Report recommended no additional action for sediments near Outfalls 9–15, pending results of bioassays by the Naval Ocean Systems Center.

Table 2-1
Site 1 – Offshore Sediment Sampling Results of Offshore Sediment Analyses Verification Study (results reported in milligrams per kilogram)

Sample Location[a]	Sample Depth (feet bgs)	Date Sampled (1984)	Cadmium	Chromium	Hexavalent Chromium	Copper	Lead	Mercury	Nickel	Silver[b]	Zinc
Effects-Range Low			1.2	81	NA	34	46.7	0.15	20.9	1.0	150
Effects-Range Median			9.6	370	NA	270	218	0.71	51.6	3.7	410
S-1-9-1	0 – 1.5	11/15	2.50	25.8	NT	23.8	33.2	NT	1.0	< 2.5	58.5
S-1-9-1	1.5 – 2	11/20	1.63	19.9	< 0.5	14.8	18.5	NT	3.3	< 2.5	52.9
S-1-10-1	0 – 1.5	11/15	1.17	134.0	NT	9.7	10.2	NT	< 0.5	< 2.5	43.4
S-1-10-1	1.5 – 2.5	11/20	< 0.50	9.0	< 0.5	7.9	4.5	NT	< 0.5	< 2.5	34.8
S-1-11-1	0 – 1.5	11/15	0.82	47.8	NT	9.7	15.4	NT	< 0.5	< 2.5	31.9
S-1-11-1	1.5 – 2	11/20	2.14	**786.0**[c]	< 0.5	79.8	47.9	NT	2.1	< 2.5	**988.0**
S-1-11-2	0 – 1.5	11/15	**10.8**	194.0	NT	25.8	22.1	NT	9.0	< 2.5	67.3
S-1-11-2	1.5 – 2	11/20	**47.4**	190.0	< 0.5	48.1	69.8	NT	< 0.5	< 2.5	119.4
S-1-11-3	0 – 1.0	11/15	**43.5**	195.0	NT	34.0	24.7	NT	< 0.5	< 2.5	50.0
S-1-11-3	1 – 1.5	11/20	**17.7**	219.3	< 0.5	43.3	34.4	NT	1.8	< 2.5	36.4
S-1-11-3	1.5 – 2.5	11/20	**31.2**	181.3	< 0.5	38.8	29.7	NT	2.1	< 2.5	66.0
S-1-11-4	0 – 1.5	11/15	5.98	112.5	NT	20.4	22.9	NT	< 0.5	< 2.5	39.6
S-1-11-4	1.5 – 2.5	11/20	4.39	35.1	< 0.5	10.4	10.8	NT	0.7	< 2.5	26.8
S-1-11-5	0 – 1.0	11/15	**16.6**	56.2	NT	11.1	18.6	NT	< 0.5	< 2.5	24.9
S-1-11-5	1 – 1.5	11/20	0.5	4.0	< 0.5	1.5	< 2.5	NT	2.2	< 2.5	10.8
S-1-11-5	1.5 – 2.5	11/20	3.91	24.5	< 0.5	8.8	13.4	NT	1.7	< 2.5	34.0
S-1-11-6	0 – 1.0	11/15	7.40	110.3	NT	18.0	21.2	NT	< 0.5	< 2.5	29.2
S-1-11-6	1 – 1.5	11/20	4.38	72.8	< 0.5	14.7	10.9	NT	2.1	< 2.5	22.3
S-1-11-6	1.5 – 2.5	11/20	0.5	9.5	< 0.5	3.4	3.9	NT	2.3	< 2.5	17.3

(table continues)

Table 2-1 (continued)

Sample Location[a]	Sample Depth (feet bgs)	Date Sampled (1984)	Cadmium	Chromium	Hexavalent Chromium	Copper	Lead	Mercury	Nickel	Silver[b]	Zinc
Effects-Range Low			1.2	81	NA	34	46.7	0.15	20.9	1.0	150
Effects-Range Median			9.6	370	NA	270	218	0.71	51.6	3.7	410
S-1-11-7	1 – 1.5	11/15	**11.5**	133.0	NT	28.0	28.9	NT	1.3	< 2.5	45.7
S-1-11-7	1.5 – 2.5	11/20	**15.4**	184.9	< 0.5	58.9	23.7	NT	2.5	< 2.5	58.6
S-1-11-8	0 – 1.5	11/15	8.41	175.0	NT	27.4	44.5	NT	5.5	< 2.5	34.8
S-1-12-1	0 – 1.5	11/15	**16.9**	255.0	NT	46.1	77.0	NT	2.7	< 2.5	71.2
S-1-12-1	1 – 2	11/20	2.47	141.9	< 0.5	57.5	40.0	NT	19.2	< 2.5	295.1
S-1-13-1	0 – 0.5	11/16	< 0.5	6.4	< 0.5	4.0	3.0	< 0.1	2.9	< 2.5	10.6
S-1-13-1	0.5 – 2.0	11/16	< 0.5	3.4	< 0.5	2.1	< 2.5	< 0.1	0.9	< 2.5	2.7
S-1-14-1	0 – 1.5	11/16	< 0.5	6.2	< 0.5	3.8	5.9	< 0.1	2.7	< 2.5	8.8
S-1-15-1	0 – 1.5	11/19	3.49	52.2	< 0.5	82.4	153.0	NT	8.3	< 2.5	107.7
S-1-15-1	1.5 – 2.5	11/19	4.85	80.4	< 0.5	101.2	191.0	NT	18.4	< 2.5	157.5
S-1-C-1	0 – 1.5	11/16	< 0.5	12.2	< 0.5	102.0	11.4	< 0.1	4.3	< 2.5	82.3
S-1-C-2	0 – 1.5	11/19	< 0.50	10.9	NT	4.7	8.9	NT	< 0.5	< 2.5	17.6

Source:
HLA 1985

Notes:
[a] sampling locations shown in Figure 2-1
[b] method detection limit is between effects-range low and effects-range median
[c] bold values are above effects-range median values (Long et al. 1995)

Acronyms/Abbreviations:
bgs – below ground surface
NA – not available
NT – not tested

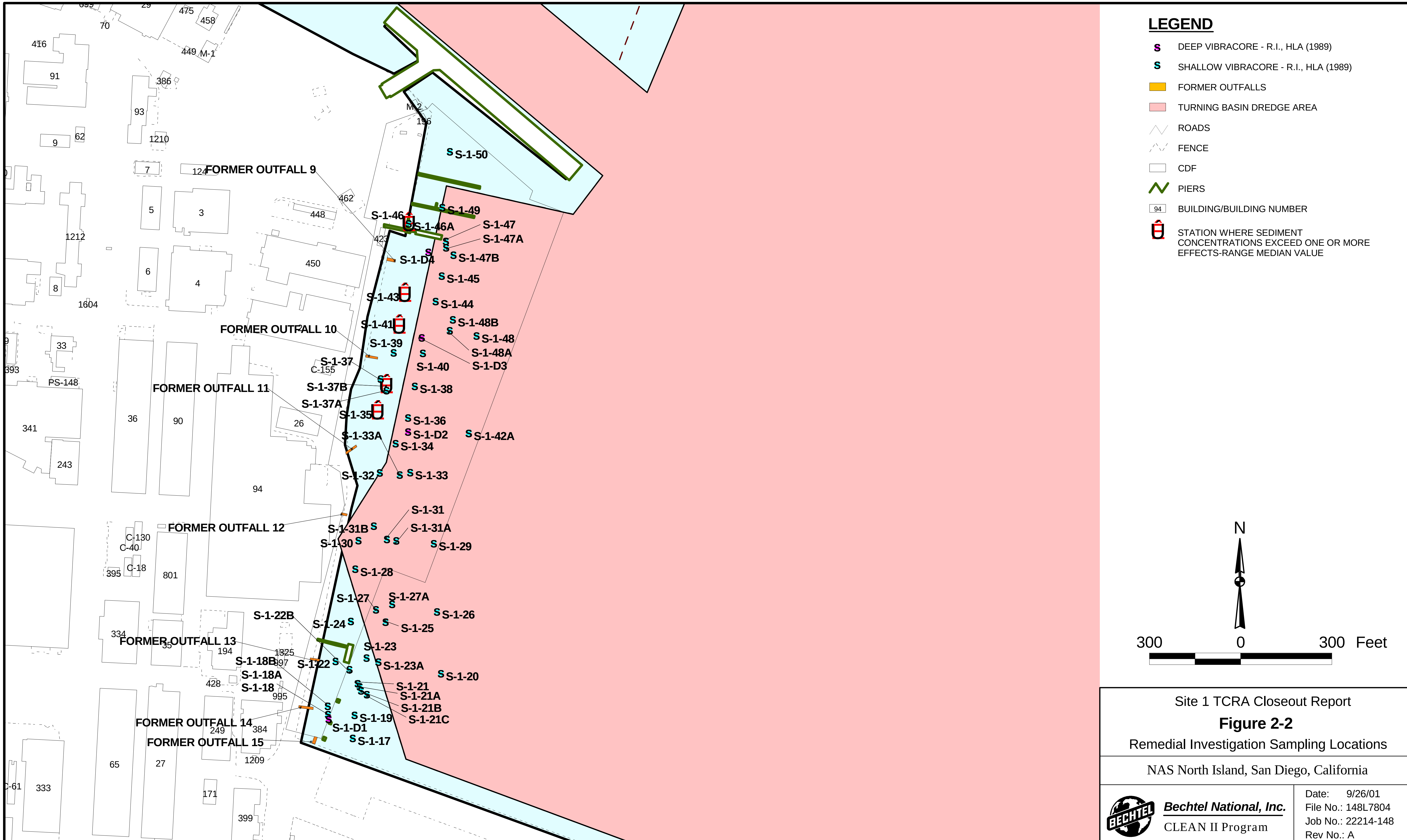

LEGEND
DEEP VIBRACORE - R.I., HLA (1989)
SHALLOW VIBRACORE - R.I., HLA (1989)
FORMER OUTFALLS
TURNING BASIN DREDGE AREA
ROADS
FENCE
CDF
PIERS
BUILDING/BUILDING NUMBER
STATION WHERE SEDIMENT CONCENTRATIONS EXCEED ONE OR MORE EFFECTS-RANGE MEDIAN VALUE
FORMER OUTFALL 9
FORMER OUTFALL 10
FORMER OUTFALL 11
FORMER OUTFALL 12
FORMER OUTFALL 13
FORMER OUTFALL 14
FORMER OUTFALL 15
S-1-50
S-1-49
S-1-46
S-1-46A
S-1-47
S-1-47A
S-1-47B
S-1-D4
S-1-45
S-1-43
S-1-44
S-1-41
S-1-48B
S-1-48
S-1-48A
S-1-39
S-1-D3
S-1-40
S-1-37
S-1-37B
S-1-38
S-1-37A
S-1-35
S-1-36
S-1-D2
S-1-33A
S-1-42A
S-1-34
S-1-32
S-1-33
S-1-31
S-1-31B
S-1-31A
S-1-30
S-1-29
S-1-28
S-1-27
S-1-27A
S-1-26
S-1-22B
S-1-24
S-1-25
S-1-23
S-1-18B
S-1-22
S-1-23A
S-1-20
S-1-18A
S-1-21
S-1-18
S-1-21A
S-1-21B
S-1-19
S-1-21C
S-1-D1
S-1-17
N
300 0 300 Feet
Site 1 TCRA Closeout Report
Figure 2-2
Remedial Investigation Sampling Locations
NAS North Island, San Diego, California
Bechtel National, Inc.
CLEAN II Program
Date: 9/26/01
File No.: 148L7804
Job No.: 22214-148
Rev No.: A

Table 2-2
Total Metal Concentrations in Offshore Sediment Samples, Site 1, Outfalls 9–15[a], Remedial Investigation
(results reported in milligrams per kilogram)

Site Identification	Sample Interval (feet bgs)	Date Collected (1988)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Effects-Range Low			NA	8.2	NA	NA	1.2	81	NA	34
Effects-Range Median			NA	70	NA	NA	9.6	370	NA	270
S-1-D1	0.0 – 2.5	08/14	< 1.5	1.2	15.9	< 0.5	0.74	4.7	1.5	1.7
	2.5 – 5.0	08/14	< 1.5	2.4	18.2	< 0.5	1.3	9.7	1.8	9.9
S-D1A	0.0 – 2.5	08/14	< 1.5	1.4	11.0	< 0.5	< 0.5	8.5	1.2	18.9
	2.5 – 5.0	08/14	< 1.5	1.3	11.4	< 0.5	0.66	7.6	1.0	4.1
S-1-D2	0.0 – 2.5	08/14	< 1.5	3.1	10.2	< 0.5	1.8	68.0	1.6	19.1
	2.5 – 5.0	08/14	< 1.5	2.7	23.0	< 0.5	< 0.5	6.0	1.7	2.8
	5.0 – 7.5	08/14	< 1.5	2.2	7.3	< 0.5	0.51	4.3	< 1.0	2.6
	7.5 – 9.5	08/14	< 1.5	9.4	21.0	< 0.5	0.53	7.5	1.8	5.5
S-1-D3	0.0 – 2.5	08/14	< 1.5	1.7	19.7	< 0.5	< 0.5	3.8	1.4	1.2
	2.5 – 5.0	08/14	< 1.5	2.1	15.1	< 0.5	< 0.5	32.2	1.7	12.8
	5.0 – 7.5	08/14	< 1.5	11.3	45.1	< 0.5	2.8	20.8	4.2	20.2
	7.5 – 8.5	08/14	< 1.5	2.6	21.1	< 0.5	< 0.5	5.7	2.1	2.9
S-1-D4	0.0 – 2.5	08/14	< 1.5	2.2	20.0	< 0.5	0.59	28.2	2.0	12.5
	2.5 – 5.0	08/14	< 1.5	8.3	39.7	< 0.5	2.5	13.4	3.4	17.5
	5.0 – 6.5	08/14	< 1.5	< 1.0	7.3	< 0.5	< 0.5	2.8	< 1.0	1.1
S-1-17	0.0 – 2.5	05/25	< 1.0	5.3	26.7	< 0.5	1.0	19.4	2.5	34.1
	2.5 – 5.0	05/25	< 1.0	< 1.0	10.0	< 0.5	1.4	7.6	1.2	5.8
S-1-18B	0.2 – 2.0	05/23	< 1.0	1.6	20.7	< 0.5	2.4	16.0	1.6	33.2
S-1-19	0.0 – 2.5	05/25	< 1.0	4.1	28.9	< 0.5	0.8	14.3	2.9	19.3
	2.5 – 3.5	05/25	< 1.0	< 1.0	12.7	< 0.5	0.7	8.1	< 1.0	2.9
S-1-20	0.0 – 1.5	08/13	< 1.5	11.1	26.5	< 0.5	< 0.5	12.1	4.0	6.0
	1.5 – 3.5	08/13	< 1.5	8.7	41.4	< 0.5	0.6	29.0	4.4	58.7
S-1-21B	0.0 – 1.5	05/25	< 1.0	6.2	29.8	< 0.5	1.1	22.4	3.2	15.8
S-1-21C	0.0 – 2.0	05/25	< 1.0	9.1	36.4	< 0.5	0.9	25.5	3.7	43.3
	2.0 – 3.0	05/25	< 1.0	1.3	22.7	< 0.5	< 0.2	5.0	1.8	1.4
S-1-22B	0.0 – 2.0	05/23	< 1.0	7.5	29.5	< 0.5	0.59	24.5	2.6	45.9
	2.0 – 4.0	05/23	< 1.0	4.3	25.0	< 0.5	1.4	12.4	1.8	10.0

(table continues)

Table 2-2 (continued)

Site Identification	Sample Interval (feet bgs)	Date Collected (1988)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Effects-Range Low			NA	8.2	NA	NA	1.2	81	NA	34
Effects-Range Median			NA	70	NA	NA	9.6	370	NA	270
S-1-23A	0.0 – 1.0	05/25	< 1.0	7.0	27.6	< 0.5	0.3	18.1	2.9	36.1
S-1-24	0.0 – 2.0	05/23	< 1.0	1.0	7.0	< 0.5	0.33	25.4	< 1.0	9.0
	2.0 – 4.5	05/23	< 1.0	4.5	23.2	< 0.5	< 0.2	7.3	1.4	2.5
S-1-25	0.0 – 2.0	05/19	< 1.0	< 1.0	20.5	< 0.5	1.1	11.9	1.8	14.4
	2.0 – 4.5	05/19	< 1.0	1.6	19.7	< 0.5	1.0	22.7	1.9	26.6
S-1-26	0.2 – 2.0	08/13	< 1.5	12.0	42.9	< 0.5	0.67	30.4	4.5	63.2
	2.0 – 4.0	08/13	< 1.5	1.6	23.0	< 0.5	< 0.5	5.1	1.7	2.3
S-1-28	0.0 – 2.5	05/23	< 1.0	1.5	13.3	< 0.5	1.2	16.8	< 1.0	8.4
	2.5 – 5.0	05/23	< 1.0	4.4	9.1	< 0.5	< 0.2	6.7	1.4	1.5
S-1-29	0.0 – 1.5	08/14	< 1.5	9.5	40.9	< 0.5	0.75	30.6	4.4	61.5
	1.5 – 3.5	08/14	< 1.5	12.3	46.9	< 0.5	1.3	39.0	4.8	60.2
S-1-30	0.0 – 2.0	05/23	< 1.0	2.0	15.0	< 0.5	1.5	14.5	1.2	16.8
	2.0 – 4.0	05/23	< 1.0	1.0	5.6	< 0.5	< 0.2	3.4	< 1.0	1.8
S-1-31B	0.0 – 2.5	05/24	< 1.0	1.8	10.1	< 0.5	0.35	27.8	1.1	8.2
	2.5 – 4.5	05/24	< 1.0	1.7	5.7	< 0.5	< 0.2	4.4	< 1.0	1.4
S-1-32	0.0 – 2.5	05/23	< 1.0	< 1.0	26.5	< 0.5	2.7	99.9	< 1.0	39.2
	2.5 – 4.5	05/23	< 1.0	1.0	11.8	< 0.5	1.0	6.4	< 1.0	6.1
S-1-33A	0.0 – 2.5	05/24	< 1.0	1.4	7.8	< 0.5	0.37	14.8	< 1.0	3.9
	2.0 – 3.5	05/24	< 1.0	5.5	27.3	< 0.5	< 0.2	6.5	1.1	< 1.0
S-1-34	0.0 – 2.0	05/23	< 1.0	1.4	35.9	< 0.5	1.9	175	1.5	37.6
	2.5 – 4.5	05/23	< 1.0	< 1.0	40.2	< 0.5	3.0	43.0	1.1	12.9
S-1-35	0.0 – 1.5	05/19	< 1.0	< 1.0	11.9	< 0.5	**13.1**[b]	144	1.0	21.6
	1.5 – 3.0	05/19	< 1.0	1.1	12.6	< 0.5	2.3	193	1.5	47.5
S-1-36	0.2 – 2.0	05/19	< 1.0	< 1.0	12.3	< 0.5	0.2	11.5	1.1	8.1
	2.0 – 4.0	05/19	< 1.0	< 1.0	7.9	< 0.5	< 0.2	2.3	1.1	< 1.0
S-1-37B	0.0 – 2.5	05/23	< 1.0	1.0	15.7	< 0.5	4.1	50.9	< 1.0	10.4
	2.5 – 4.5	05/23	< 1.0	2.7	50.7	< 0.5	**14.7**	47.6	1.7	30.0

(table continues)

Table 2-2 (continued)

Site Identification	Sample Interval (feet bgs)	Date Collected (1988)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Effects-Range Low			NA	8.2	NA	NA	1.2	81	NA	34
Effects-Range Median			NA	70	NA	NA	9.6	370	NA	270
S-1-38	0.0 – 2.0	05/19	< 1.0	< 1.0	22.9	< 0.5	< 0.2	12.3	1.3	7.6
	2.0 – 4.5	05/19	< 1.0	< 1.0	24.8	< 0.5	< 0.2	5.4	1.2	1.7
S-1-39	0.0 – 2.0	05/23	< 1.0	< 1.0	10.0	< 0.5	0.54	137	< 1.0	6.6
	2.0 – 4.0	05/23	< 1.0	< 1.0	25.0	< 0.5	1.4	11.2	< 1.0	6.7
S-1-40	0.0 – 2.5	05/19	< 1.0	< 1.0	16.7	< 0.5	< 0.2	12.1	1.2	4.6
	2.5 – 5.0	05/19	< 1.0	< 1.0	21.3	< 0.5	< 0.2	3.0	1.4	< 1.0
S-1-41	0.0 – 2.5	05/23	< 1.0	1.2	7.6	< 0.5	0.47	**559**	< 1.0	6.1
	2.5 – 4.5	05/23	< 1.0	2.3	35.1	< 0.5	8.4	45.3	1.6	25.5
S-1-42	0.0 – 1.5	08/14	< 1.5	5.9	25.4	< 0.5	1.0	28.6	2.7	38.1
	1.5 – 4.0	08/14	< 1.5	2.5	19.3	< 0.5	1.5	23.0	2.1	17.7
S-1-42B	0.0 – 2.0	08/14	< 1.5	4.8	17.5	< 0.5	< 0.5	15.4	2.0	22.5
S-1-43	0.0 – 2.0	05/23	< 1.0	1.0	13.0	< 0.5	< 0.2	**725**	1.5	8.6
	2.0 – 4.0	05/23	< 1.0	1.8	15.5	< 0.5	0.45	**553**	1.8	5.5
S-1-44	0.0 – 2.0	05/23	< 1.0	< 1.0	9.1	< 0.5	< 0.2	4.9	< 1.0	3.5
	2.0 – 4.0	05/23	< 1.0	< 1.0	7.6	< 0.5	< 0.2	1.9	< 1.0	11.1
S-1-45	0.0 – 2.5	05/24	< 1.0	< 1.0	9.8	< 0.5	< 0.2	4.2	< 1.0	1.4
	2.5 – 5.0	05/24	< 1.0	< 1.0	13.1	< 0.5	< 0.2	3.1	1.1	< 1.0
S-1-46	0.0 – 1.0	05/24	< 1.0	2.3	19.1	< 0.5	1.4	34.9	1.6	136
S-1-46A	0.0 – 1.0	05/24	< 1.0	3.4	38.9	< 0.5	0.67	26.1	1.3	142
S-1-47B	0.0 – 2.5	05/24	< 1.0	3.6	20.8	< 0.5	0.40	12.8	1.6	7.2
	2.5 – 4.5	05/24	< 1.0	2.1	9.7	< 0.5	< 0.2	4.4	1.3	< 1.0
S-1-48	0.0 – 2.5	08/13	< 1.5	2.2	19.0	< 0.5	< 0.5	15.8	1.9	18.2
S-1-49	0.0 – 2.5	05/24	< 1.0	4.4	39.2	< 0.5	1.0	15.1	1.7	24.0
	2.5 – 4.5	05/24	< 1.0	1.7	13.4	< 0.5	< 0.2	4.3	1.6	< 1.0
S-1-50	0.0 – 2.0	08/13	< 1.5	3.9	38.9	< 0.5	1.0	22.6	2.7	44.8
	2.0 – 4.5	08/13	< 1.5	3.4	28.8	< 0.5	< 0.5	7.7	3.0	6.7

(table continues)

Table 2-2 (continued)

Site Identification	Sample Interval (feet bgs)	Date Collected (1988)	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Effects-Range Low			46.2	0.15	NA	20.9	NA	1.0	NA	NA	150
Effects-Range Median			218	0.71	NA	51.6	NA	3.7	NA	NA	410
S-1-D1	0.0 – 2.5	08/14	1.3	< 0.25	2.8	1.3	< 1.0	< 2.5	< 1.0	10.4	18.9
	2.5 – 5.0	08/14	20.1	< 0.25	3.3	2.1	< 1.0	< 2.5	< 1.0	12.1	253
S-D1A	0.0 – 2.5	08/14	14.4	< 0.25	2.3	2.0	< 1.0	< 2.5	< 1.0	7.6	36.9
	2.5 – 5.0	08/14	12.3	< 0.25	2.6	1.3	< 1.0	< 2.5	< 1.0	7.4	18.6
S-1-D2	0.0 – 2.5	08/14	11.6	< 0.25	2.4	2.6	< 1.0	< 2.5	< 1.0	8.1	44.8
	2.5 – 5.0	08/14	2.6	< 0.25	3.0	1.6	< 1.0	< 2.5	< 1.0	11.9	15.4
	5.0 – 7.5	08/14	4.1	< 0.25	2.7	1.1	< 1.0	< 2.5	< 1.0	8.1	12.6
	7.5 – 9.5	08/14	7.1	< 0.25	5.1	2.3	< 1.0	< 2.5	< 1.0	17.1	21.7
S-1-D3	0.0 – 2.5	08/14	< 1.5	< 0.25	2.0	1.1	< 1.0	< 2.5	< 1.0	8.6	13.4
	2.5 – 5.0	08/14	9.2	< 0.25	2.9	2.1	< 1.0	< 2.5	< 1.0	10.9	34.8
	5.0 – 7.5	08/14	39.1	< 0.25	6.7	5.8	< 1.0	< 2.5	< 1.0	27.1	134
	7.5 – 8.5	08/14	3.0	< 0.25	3.1	2.0	< 1.0	< 2.5	< 1.0	11.3	31.3
S-1-D4	0.0 – 2.5	08/14	14.1	< 0.25	3.3	2.3	< 1.0	< 2.5	1.2	12.5	34.7
	2.5 – 5.0	08/14	41.8	0.48	5.6	4.6	< 1.0	< 2.5	< 1.0	21.7	76.9
	5.0 – 6.5	08/14	< 1.5	< 0.25	1.5	< 1.0	< 1.0	< 2.5	< 1.0	5.4	9.5
S-1-17	0.0 – 2.5	05/25	39.0	< 0.25	< 1.0	3.5	< 1.0	< 2.5	< 1.0	18.1	67.0
	2.5 – 5.0	05/25	19.5	< 0.25	< 1.0	< 0.5	< 1.0	< 2.5	< 1.0	5.5	27.1
S-1-18B	0.2 – 2.0	05/23	61.1	< 0.25	< 1.0	2.9	< 1.0	< 2.5	< 1.0	12.4	68.0
S-1-19	0.0 – 2.5	05/25	18.0	< 0.25	< 1.0	2.5	< 1.0	< 2.5	< 1.0	17.0	43.2
	2.5 – 3.5	05/25	23.2	< 0.25	< 1.0	< 0.5	< 1.0	< 2.5	< 1.0	7.5	15.1
S-1-20	0.0 – 1.5	08/13	3.6	< 0.25	6.0	3.7	< 1.0	< 2.5	< 1.0	25.3	24.3
	1.5 – 3.5	08/13	27.5	0.28	7.2	7.0	< 1.0	< 2.5	< 1.0	27.8	116
S-1-21B	0.0 – 1.5	05/25	16.2	< 0.25	< 1.0	4.0	< 1.0	< 2.5	< 1.0	22.5	46.7
S-1-21C	0.0 – 2.0	05/25	25.0	0.27	1.3	4.8	< 1.0	< 2.5	< 1.0	24.6	76.1
	2.0 – 3.0	05/25	2.4	< 0.25	< 1.0	< 0.5	< 1.0	< 2.5	< 1.0	10.7	12.6
S-1-22B	0.0 – 2.0	05/23	32.3	0.30	< 1.0	6.0	< 1.0	< 2.5	< 1.0	22.0	87.2
	2.0 – 4.0	05/23	14.6	< 0.25	< 1.0	2.5	< 1.0	< 2.5	< 1.0	15.8	27.2
S-1-23A	0.0 – 1.0	05/25	17.0	< 0.25	1.2	3.2	< 1.0	< 2.5	< 1.0	20.9	51.0

(table continues)

Table 2-2 (continued)

Site Identification	Sample Interval (feet bgs)	Date Collected (1988)	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Effects-Range Low			46.2	0.15	NA	20.9	NA	1.0	NA	NA	150
Effects-Range Median			218	0.71	NA	51.6	NA	3.7	NA	NA	410
S-1-24	0.0 – 2.0	05/23	8.0	< 0.25	< 1.0	1.7	< 1.0	< 2.5	< 1.0	5.7	19.5
	2.0 – 4.5	05/23	< 1.0	< 0.25	< 1.0	1.6	< 1.0	< 2.5	< 1.0	16.4	10.6
S-1-25	0.0 – 2.0	05/19	18.5	0.28	1.5	2.6	< 1.0	< 2.5	< 1.0	12.6	39.7
	2.0 – 4.5	05/19	27.3	< 0.25	1.3	3.0	< 1.0	< 2.5	< 1.0	14.9	56.4
S-1-26	0.2 – 2.0	08/13	30.9	0.35	7.6	7.3	< 1.0	< 2.5	< 1.0	28.9	115
	2.0 – 4.0	08/13	1.9	< 0.25	2.7	1.4	< 1.0	< 2.5	< 1.0	10.6	13.7
S-1-28	0.0 – 2.5	05/23	30.5	< 0.25	< 1.0	2.0	< 1.0	< 2.5	< 1.0	7.7	34.3
	2.5 – 5.0	05/23	1.6	< 0.25	< 1.0	2.2	< 1.0	< 2.5	< 1.0	13.1	9.7
S-1-29	0.0 – 1.5	08/14	31.2	0.26	7.4	7.1	< 1.0	< 2.5	< 1.0	28.0	114
	1.5 – 3.5	08/14	37.3	0.56	8.2	8.0	< 1.0	< 2.5	< 1.0	30.9	131
S-1-30	0.0 – 2.0	05/23	31.2	< 0.25	< 1.0	2.2	< 1.0	< 2.5	< 1.0	11.2	39.7
	2.0 – 4.0	05/23	1.8	< 0.25	< 1.0	1.2	< 1.0	< 2.5	< 1.0	3.8	7.5
S-1-31B	0.0 – 2.5	05/24	14.4	< 0.25	< 1.0	4.2	< 1.0	< 2.5	< 1.0	7.2	28.9
	2.5 – 4.5	05/24	1.4	< 0.25	< 1.0	3.8	< 1.0	< 2.5	< 1.0	5.9	7.3
S-1-32	0.0 – 2.5	05/23	54.8	< 0.25	1.6	5.4	< 1.0	< 2.5	< 1.0	6.3	66.1
	2.5 – 4.5	05/23	16.3	< 0.25	< 1.0	< 1.0	< 1.0	< 2.5	< 1.0	9.7	24.1
S-1-33A	0.0 – 2.0	05/24	4.5	< 0.25	< 1.0	3.7	< 1.0	< 2.5	< 1.0	5.8	15.7
	2.0 – 3.5	05/24	2.3	< 0.25	< 1.0	5.5	< 1.0	< 2.5	< 1.0	14.0	9.6
S-1-34	0.0 – 2.5	05/23	61.1	0.26	< 1.0	3.9	< 1.0	< 2.5	< 1.0	15.2	83.1
	2.5 – 4.5	05/23	24.2	< 0.25	< 1.0	1.6	< 1.0	< 2.5	< 1.0	13.4	40.1
S-1-35	0.0 – 1.5	05/19	20.9	< 0.25	< 1.0	2.1	< 1.0	< 2.5	< 1.0	8.8	36.9
	1.5 – 3.0	05/19	63.7	< 0.25	< 1.0	3.1	< 1.0	< 2.5	< 1.0	10.6	57.2
S-1-36	0.2 – 2.0	05/19	6.1	< 0.25	< 1.0	1.2	< 1.0	< 2.5	< 1.0	8.5	17.8
	2.0 – 4.0	05/19	1.8	< 0.25	1.1	0.86	< 1.0	< 2.5	< 1.0	6.2	8.3
S-1-37B	0.0 – 2.5	05/23	14.0	< 0.25	< 1.0	2.5	< 1.0	< 2.5	< 1.0	10.8	27.7
	2.5 – 4.5	05/23	105	0.34	< 1.0	3.5	< 1.0	< 2.5	< 1.0	17.7	125
S-1-38	0.0 – 2.0	05/19	6.8	< 0.25	< 1.0	1.4	< 1.0	< 2.5	< 1.0	9.7	21.6
	2.0 – 4.5	05/19	3.6	< 0.25	< 1.0	1.4	< 1.0	< 2.5	< 1.0	13.0	15.1

(table continues)

Table 2-2 (continued)

Site Identification	Sample Interval (feet bgs)	Date Collected (1988)	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Effects-Range Low			46.2	0.15	NA	20.9	NA	1.0	NA	NA	150
Effects-Range Median			218	0.71	NA	51.6	NA	3.7	NA	NA	410
S-1-39	0.0 – 2.0	05/23	6.8	< 0.25	< 1.0	< 1.0	< 1.0	< 2.5	< 1.0	6.7	10.6
	2.0 – 4.0	05/23	15.0	< 0.25	< 1.0	< 1.0	< 1.0	< 2.5	< 1.0	7.5	22.3
S-1-40	0.0 – 2.5	05/19	5.0	< 0.25	< 1.0	1.3	< 1.0	< 2.5	< 1.0	9.9	17.0
	2.5 – 5.0	05/19	< 1.0	< 0.25	1.5	0.77	< 1.0	< 2.5	< 1.0	9.0	8.9
S-1-41	0.0 – 2.5	05/23	5.7	< 0.25	< 1.0	1.4	< 1.0	< 2.5	< 1.0	6.9	24.7
	2.5 – 4.5	05/23	54.2	0.26	< 1.0	3.5	< 1.0	< 2.5	< 1.0	12.2	71.9
S-1-42	0.0 – 1.5	08/14	35.2	< 0.25	5.1	4.7	< 1.0	< 2.5	< 1.0	18.1	89.1
	1.5 – 4.0	08/14	24.4	< 0.25	4.8	3.4	< 1.0	< 2.5	< 1.0	14.1	49.1
S-1-42B	0.0 – 2.0	08/14	14.5	< 0.25	3.7	3.0	< 1.0	< 2.5	< 1.0	13.1	58.0
S-1-43	0.0 – 2.0	05/23	6.4	< 0.25	< 1.0	1.4	< 1.0	< 2.5	< 1.0	7.7	22.1
	2.0 – 4.0	05/23	7.6	< 0.25	< 1.0	1.6	< 1.0	< 2.5	< 1.0	10.5	24.3
S-1-44	0.0 – 2.0	05/23	3.2	< 0.25	< 1.0	< 1.0	< 1.0	< 2.5	< 1.0	6.1	13.1
	2.0 – 4.0	05/23	< 1.0	< 0.25	< 1.0	< 1.0	< 1.0	< 2.5	< 1.0	4.8	8.7
S-1-45	0.0 – 2.5	05/24	3.1	< 0.25	< 1.0	3.5	< 1.0	< 2.5	< 1.0	4.9	11.5
	2.5 – 5.0	05/24	3.5	< 0.25	< 1.0	3.6	< 1.0	< 2.5	< 1.0	6.1	12.2
S-1-46	0.0 – 1.0	05/24	72.8	< 0.25	< 1.0	5.1	< 1.0	< 2.5	< 1.0	7.9	349
S-1-46A	0.0 – 1.0	05/24	**242**	< 0.25	< 1.0	6.8	< 1.0	< 2.5	< 1.0	12.8	296
S-1-47B	0.0 – 2.5	05/24	12.7	< 0.25	< 1.0	4.9	< 1.0	< 2.5	< 1.0	10.9	30.2
	2.5 – 4.5	05/24	2.4	< 0.25	< 1.0	4.6	< 1.0	< 2.5	< 1.0	7.2	9.9
S-1-48	0.0 – 2.5	08/13	12.9	< 0.25	3.5	2.6	< 1.0	< 2.5	< 1.0	12.4	46.1
S-1-49	0.0 – 2.5	05/24	15.4	< 0.25	< 1.0	7.8	< 1.0	< 2.5	< 1.0	11.8	67.1
	2.5 – 4.5	05/24	1.6	< 0.25	< 1.0	4.3	< 1.0	< 2.5	< 1.0	10.0	11.1
S-1-50	0.0 – 2.0	08/13	87.4	< 0.25	4.9	4.4	< 1.0	< 2.5	< 1.0	16.4	117
	2.0 – 4.5	08/13	3.7	< 0.25	5.9	3.0	< 1.0	< 2.5	< 1.0	15.9	22.7

Source: HLA 1989

Notes:
[a] all samples processed within the minimum holding time (28 days for mercury)
[b] bold values are above effects-range median values (Long et al. 1995)

Acronyms/Abbreviations:
bgs – below ground surface
NA – not available

Table 2-3
Total Organic Halides and Petroleum Hydrocarbon Concentrations in Offshore Sediment Samples, Site 1, Outfalls 9–15, Remedial Investigation (results reported in milligrams per kilogram)

Site Identification	Sample Depth (feet bgs)	Date Collected (1988)	Total Organic Halide*	Total Recoverable Petroleum Hydrocarbons*
S-1-D1	0.0 – 2.5	08/14	< 4	80
	2.5 – 5.0	08/14	< 4	68
S-D1A	0.0 – 2.5	08/14	< 4	220
	2.5 – 5.0	08/14	< 4	220
S-1-D2	0.0 – 2.5	08/14	< 4	51
	2.5 – 5.0	08/14	< 4	15
	5.0 – 7.5	08/14	< 4	14
	7.5 – 9.5	08/14	< 4	52
S-1-D3	0.0 – 2.5	08/14	< 4	12
	2.5 – 5.0	08/14	< 4	40
	5.0 – 7.5	08/14	< 4	40
	7.5 – 9.5	08/14	< 4	39
S-1-D4	0.0 – 2.5	08/14	< 4	26
	2.5 – 5.0	08/14	< 4	200
	5.0 – 6.5	08/14	< 4	25
S-1-4	0.0 – 1.5	08/14	< 4	280
S-1-17	0.0 – 2.5	05/25	< 8	270
	2.5 – 5.0	05/25	< 8	370
S-1-18B	0.0 – 2.0	05/23	< 8	140
S-1-19	0.0 – 2.0	05/25	< 8	320
	2.0 – 3.5	05/25	< 8	350
S-1-20	0.0 – 1.5	08/13	< 4	36
	1.5 – 3.5	08/13	< 4	49
S-1-21B	0.0 – 1.5	05/25	< 8	240
S-1-21C	0.0 – 2.0	05/25	< 8	260
	2.0 – 3.0	05/25	< 8	26
S-1-22B	0.0 – 2.0	05/23	< 8	59
	2.0 – 4.0	05/23	< 8	220
S-1-23A	0.0 – 1.0	05/25	< 8	100
S-1-24	0.0 – 2.0	05/23	< 8	34
	2.0 – 4.5	05/23	< 8	3

(table continues)

Table 2-3 (continued)

Site Identification	Sample Depth (feet bgs)	Date Collected (1988)	Total Organic Halide*	Total Recoverable Petroleum Hydrocarbons*
S-1-25	0.0 – 2.0	05/19	< 8	310
	2.0 – 4.5	05/19	< 8	67
S-1-26	0.2 – 2.0	08/13	< 4	350
	2.0 – 4.0	08/13	< 4	46
S-1-28	0.0 – 2.5	05/23	< 8	75
	2.5 – 5.0	05/23	< 8	4
S-1-29	0.0 – 1.5	08/14	< 4	110
	1.5 – 3.5	08/14	< 4	140
S-1-30	0.0 – 2.0	05/23	< 8	86
	2.0 – 4.0	05/23	< 8	6
S-1-31B	0.0 – 2.5	05/24	< 8	44
	2.5 – 4.5	05/24	< 8	5
S-1-32	0.0 – 2.5	05/23	< 8	77
	2.5 – 4.5	05/23	< 8	31
S-1-33A	0.0 – 2.0	05/24	< 8	39
	2.0 – 3.5	05/24	< 8	6
S-1-34	0.0 – 2.5	05/23	< 8	410
	2.5 – 4.5	05/23	< 8	390
S-1-35	0.0 – 1.5	05/19	< 8	130
	1.5 – 3.0	05/19	< 8	200
S-1-36	0.2 – 2.0	05/19	< 8	23
	2.0 – 4.0	05/19	< 8	4
S-1-37B	0.0 – 2.5	05/23	< 8	58
	2.5 – 4.5	05/23	< 8	370
S-1-38	0.0 – 2.0	05/19	< 8	33
	2.0 – 4.5	05/19	< 8	11
S-1-39	0.0 – 2.0	05/23	< 8	35
	2.0 – 4.0	05/23	< 8	45
S-1-40	0.0 – 2.5	05/19	< 8	56
	2.5 – 5.0	05/19	< 8	4
S-1-41	0.0 – 2.5	05/23	< 8	33
	2.5 – 4.5	05/23	< 8	210
S-1-42	1.5 – 4.0	08/14	< 4	220
S-1-42B	0.0 – 2.0	08/14	< 4	60

(table continues)

Table 2-3 (continued)

Site Identification	Sample Depth (feet bgs)	Date Collected (1988)	Total Organic Halide*	Total Recoverable Petroleum Hydrocarbons*
S-1-43	0.0 – 2.0	05/23	< 8	57
	2.0 – 4.0	05/23	< 8	130
S-1-44	0.0 – 2.0	05/23	< 8	16
	2.0 – 4.0	05/23	< 8	5
S-1-45	0.0 – 2.5	05/24	< 8	29
	2.5 – 5.0	05/24	< 8	12
S-1-46	0.0 – 1.0	05/24	< 8	400
S-1-46A	0.0 – 1.0	05/24	< 8	410
S-1-47B	0.0 – 2.5	05/24	< 8	43
	2.5 – 4.5	05/24	< 8	6
S-1-48	0.0 – 2.5	08/13	< 4	54
S-1-49	0.0 – 2.5	05/24	< 8	79
	2.5 – 4.5	05/24	< 8	9
S-1-50	0.0 – 2.0	08/13	< 4	99
	2.0 – 4.5	08/13	< 4	12

Source:
HLA 1989

Note:
* effects-range low and effects-range median values are not established for total organic halides or total recoverable petroleum hydrocarbons

Acronym/Abbreviation:
bgs – below ground surface

Table 2-4
Semivolatile Organic Concentrations in Offshore Sediment Samples, Site 1, Outfalls 9–15, Remedial Investigation
(results reported in milligrams per kilogram)

Site ID	Sample Depth (feet bgs)	Date Collected (1988)	bis(2-ethylhexyl) phthalate	Butylbenzyl phthalate	Chrysene	Fluoranthene	Indeno (1,2,3-c,d)pyrene	Phenanthrene	Pyrene
Effects-Range Low			NA	NA	0.384	0.6	NA	0.24	0.665
Effects-Range Median			NA	NA	2.8	5.1	NA	1.50	2.60
S-1-D1	2.5 – 5.0	08/14	0.70	< 0.17	0.93	0.95	< 0.17	< 0.17	1.4
S-D1A	2.5 – 5.0	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-D4	2.5 – 5.0	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
	5.0 – 6.5	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-17	2.5 – 5.0	05/25	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-18B	0.2 – 2.0	05/23	< 0.17	< 0.17	0.17	< 0.17	< 0.17	< 0.17	0.17
S-1-19	0.0 – 2.0	05/25	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	0.23
S-1-21C	0.0 – 2.0	05/25	< 0.17	< 0.17	< 0.17	< 0.17	0.17	< 0.17	< 0.17
S-1-22B	2.0 – 4.0	05/23	0.37	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-25	0.0 – 2.0	05/19	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	0.17
S-1-26	0.2 – 2.0	08/13	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-29	1.5 – 3.5	08/14	< 0.17	< 0.17	0.28	< 0.17	< 0.17	< 0.17	0.47
S-1-34	0.0 – 2.5	05/23	4.4	< 0.17	0.33	0.17	0.17	0.17	1.4
S-1-35	1.5 – 3.0	05/19	< 0.17	< 0.17	0.23	< 0.17	< 0.17	0.17	0.23
S-1-37B	2.5 – 4.5	05/23	< 0.17	< 0.17	< 0.17	0.17	0.17	0.17	0.17
S-1-41	2.5 – 4.5	05/23	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-42	1.5 – 4.0	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-43	2.0 – 4.0	05/23	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
S-1-46A	0.0 – 1.0	05/24	0.97	< 0.17	0.68	10.17	0.37	0.56	0.99
S-1-50	0.0 – 2.0	08/13	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17

(table continues)

Table 2-4 (continued)

Site ID	Sample Depth (feet bgs)	Date Collected (1988)	Benz(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Benzoic Acid
Effects-Range Low			0.261	0.43	NA	NA	NA	NA
Effects-Range Median			1.600	1.60	NA	NA	NA	NA
S-1-D1	2.5 – 5.0	08/14	0.30	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-D1A	2.5 – 5.0	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-D4	2.5 – 5.0	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
	5.0 – 6.5	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-17	2.5 – 5.0	05/25	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-18B	0.0 – 2.0	05/23	< 0.17	< 0.17	0.17	< 0.17	< 0.17	< 0.85
S-1-19	0.0 – 2.0	05/25	0.17	< 0.17	0.23	< 0.17	< 0.17	< 0.85
S-1-21C	0.0 – 2.0	05/25	< 0.17	0.17	0.23	0.17	< 0.17	< 0.85
S-1-22B	2.0 – 4.0	05/23	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-25	0.0 – 2.0	05/19	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-26	0.0 – 2.0	08/13	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-29	1.5 – 3.5	08/14	< 0.17	0.23	0.24	< 0.17	< 0.17	< 0.85
S-1-34	0.0 – 2.5	05/23	0.30	0.30	0.73	0.17	< 0.17	< 0.85
S-1-35	1.5 – 3.0	05/19	0.17	< 0.17	< 0.17	< 0.17	0.17	< 0.85
S-1-37B	2.5 – 4.5	05/23	< 0.17	0.17	< 0.17	0.17	0.18	< 0.85
S-1-41	2.5 – 4.5	05/23	< 0.17	< 0.17	0.17	< 0.17	< 0.17	< 0.85
S-1-42	1.5 – 4.0	08/14	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-43	2.0 – 4.0	05/23	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85
S-1-46A	0.0 – 1.0	05/24	0.55	0.50	0.72	0.30	0.68	< 0.85
S-1-50	0.0 – 2.0	08/13	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.85

Sources:
HLA 1989
Long et al. 1995

Acronyms/Abbreviations:
bgs – below ground surface
NA – not applicable

ERL and ERM values are also included in Tables 2-2, 2-3, and 2-4 for comparison. The analytical results indicate that cadmium, chromium, and lead were above their respective ERM values in one or more sediment sample analyzed. PAHs were below their respective ERM values.

2.4 BIOASSAY STUDY

In 1992, MEC Analytical Systems, Inc., conducted a series of chemical, physical, and bioassay tests on sediments collected from three locations in the turning basin (Figure 2-3). The study was designed to provide data to support ocean disposal of dredged sediments for the homeporting project. Sediments were analyzed for metals, pesticides, and polychlorinated biphenyls (PCBs), PAHs, phenols, sulfides, oil and grease, TRPH, and organotins. Liquid/suspended-phase bioassays, 10-day solid-phase toxicity tests, and a 28-day bioaccumulation study (MEC 1992) were also performed. Test results were compared to results of reference sediments collected from an offshore site approximately 6 miles west of San Diego, as specified by U.S. EPA (MEC 1992).

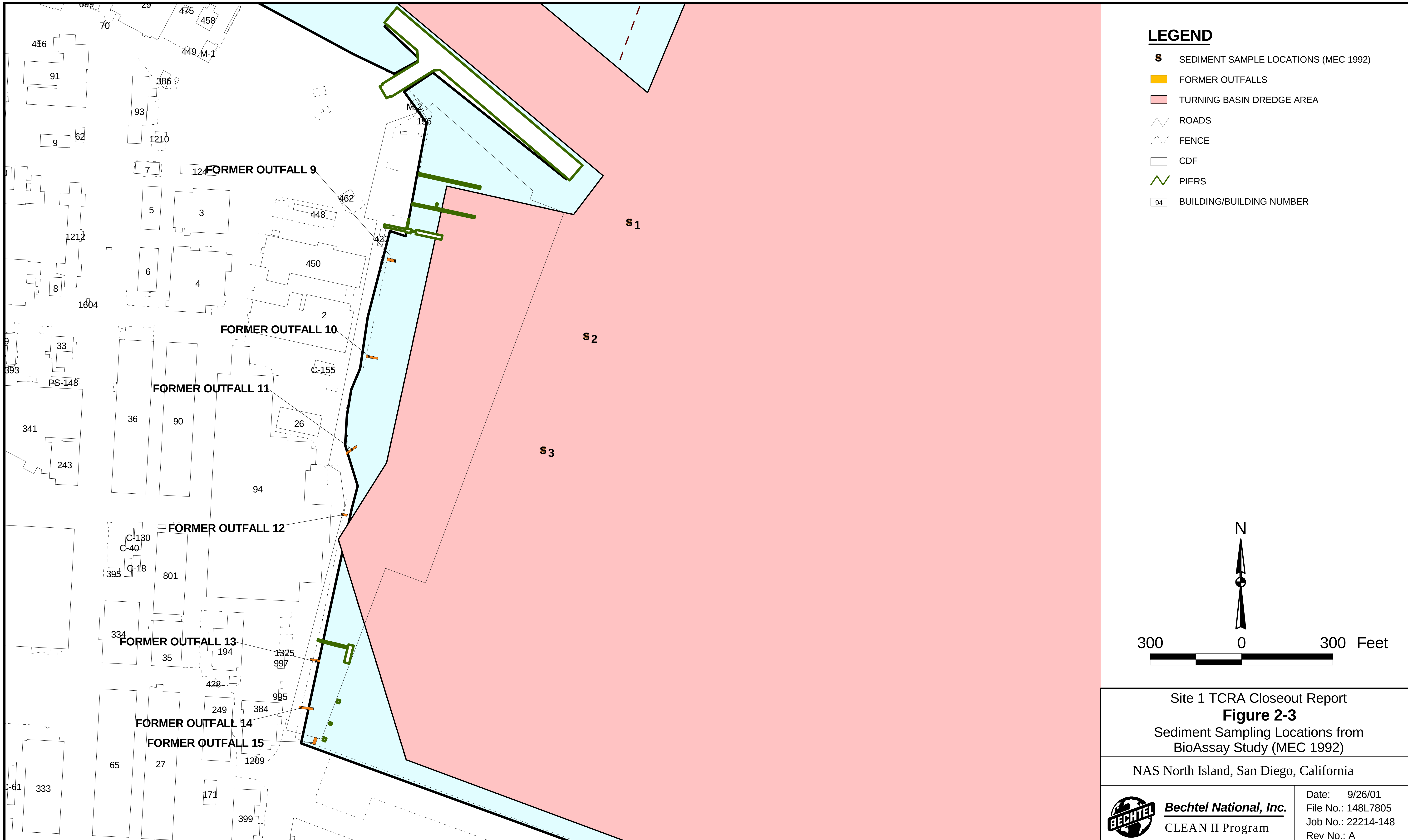
Metals reported in sediment from the turning basin were above those reported in reference sediment, in some instances by an order of magnitude. No pesticides, PCBs, or phenols were reported in the turning basin sediment, but PAHs were found at low levels (MEC 1992). The sediment chemistry results are presented in Table 2-5.

The results of the liquid/suspended studies did not indicate a potential to exceed the limiting permissible concentration (LPC) in the water column upon disposal of this material. The LPC is the concentration of any dissolved dredged material constituent that, after allowing for initial mixing, will not exceed applicable marine water-quality criteria (U.S. EPA/USACE 1991). Significant toxicity was found in the solid-phase bioassays (mysid and amphipod). Both of these tests exceeded the solid-phase LPC (MEC 1992). Table 2-6 lists the results of the solid-phase bioassay tests.

A moderate level of bioaccumulation occurred in heavy metals for both the polychaete worm (*Nephtys caecoides*) and the marine clam (*Macoma nasuta*) (Table 2-7). These levels were one to two times the reference levels and, individually, were probably not biologically significant. However, the number of analytes found in *Macoma* and in *Nephtys* caused concern regarding long-term effects at the disposal site (MEC 1992).

The results of the bioassay study suggested that the turning basin sediments at the locations sampled were not suitable for ocean disposal.

The ERL and ERM values are included in Table 2-5 for comparison. As indicated in the table, some metals exceeded the ERL values, but no analyte exceeded its respective ERM value.



Site 1 TCRA Closeout Report

Figure 2-3

Sediment Sampling Locations from BioAssay Study (MEC 1992)

NAS North Island, San Diego, California

Bechtel National, Inc.
CLEAN II Program

Date: 9/26/01
File No.: 148L7805
Job No.: 22214-148
Rev No.: A

Table 2-5
Summary of Sediment Chemistry
United States Navy Aircraft Carrier Turning Basin

Analyte/Unit[a]	Site D Turning Basin	Reference	Control	*Rhepoxynius* Control	Detection Limit[b]	ERL	ERM
Grain Size (%)							
Gravel	0.4	0.1	0.0	0.0	NA	NA	NA
Sand	49.5	56.9	96.5	96.1	NA	NA	NA
Silt	26.4	33.8	1.9	1.6	NA	NA	NA
Clay	23.7	9.2	1.7	2.3	NA	NA	NA
Solids (%) (dry weight)	60	66	87.4	85	NA	NA	NA
Total organic carbon (mg/kg)	1.05	1.1364	NA	NA	0.1	—[c]	—
Sulfides (mg/kg)							
Total	148	0.758	5.61	87.4	0.1	—	—
Water soluble	< 0.017	< 0.015	< 0.011	0.012	0.1	—	—
Organotins (µg/kg)							
Tributyltin	< 1.67	< 1.52	< 1.14	< 1.18	1.0	—	—
Dibutyltin	1.88	< 1.52	< 1.14	< 1.18	1.0	—	—
Monobutyltin	< 1.65	< 1.52	< 1.14	< 1.18	1.0	—	—
Oil and Grease (mg/kg)	117	33.2	< 11.4	< 11.8	1.0	—	—
TRPH (mg/kg)	97.3	< 15.2	< 11.4	< 11.8	1.0	—	—
Metals (mg/kg)							
Arsenic	5.82	2.02	2.73	2.26	0.1	8.2	70
Cadmium	0.933	0.167	< 0.023	0.059	0.1	1.2	9.6
Chromium	48.0	14.2	11.1	14.4	0.1	81	370
Copper	73.5	5.41	1.05	1.54	0.1	34	270
Lead	42.3	4.67	< 0.570	< 0.584	0.1	46.7	218

(table continues)

Table 2-5 (continued)

Analyte/Unit[a]	Site D Turning Basin	Reference	Control	*Rhepoxynius* Control	Detection Limit[b]	ERL	ERM
Mercury	0.642	0.036	0.031	0.045	0.02	0.15	0.71
Nickel	10.9	6.30	12.5	16.7	0.1	20.9	51.6
Selenium	< 1.53	< 1.51	< 0.114	< 0.116	0.11	—	—
Silver	1.45	0.13	0.092	0.093	0.079	1.0	3.7
Zinc	150	24.8	13.4	16.1	2.0	150	410
Pesticides and PCBs (µg/kg)							
4-4′-DDD	ND	ND	ND	ND	2	—	—
4,4′-DDE	ND	ND	ND	ND	2	2.2	27
4,4′-DDT	ND	ND	ND	ND	2	—	—
Aldrin	ND	ND	ND	ND	2	—	—
alpha-BHC	ND	ND	ND	ND	2	—	—
beta-BHC	ND	ND	ND	ND	2	—	—
delta-BHC	ND	ND	ND	ND	2	—	—
gamma-BHC	ND	ND	ND	ND	2	—	—
Chlordane	ND	ND	ND	ND	25	—	—
Dieldrin	ND	ND	ND	ND	2	—	—
Endosulfan I	ND	ND	ND	ND	10	—	—
Endosulfan II	ND	ND	ND	ND	2	—	—
Endosulfan sulfate	ND	ND	ND	ND	25	—	—
Endrin	ND	ND	ND	ND	2	—	—
Endrin aldehyde	ND	ND	ND	ND	10	—	—
Heptachlor	ND	ND	ND	ND	2	—	—
Heptachlor epoxide	ND	ND	ND	ND	10	—	—
Toxaphene	ND	ND	ND	ND	25	—	—
Aroclor 1016	ND	ND	ND	ND	20	—	—
Aroclor 1221	ND	ND	ND	ND	20	—	—

(table continues)

Table 2-5 (continued)

Analyte/Unit[a]	Site D Turning Basin	Reference	Control	*Rhepoxynius* Control	Detection Limit[b]	ERL	ERM
Aroclor 1232	ND	ND	ND	ND	20	—	—
Aroclor 1242	ND	ND	ND	ND	20	—	—
Aroclor 1248	ND	ND	ND	ND	20	—	—
Aroclor 1254	ND	ND	ND	ND	20	—	—
Aroclor 1260	ND	ND	ND	ND	20	—	—
Phenols (µg/kg)							
4-chloro-3-methylphenol	ND	ND	ND	ND	10	—	—
2-chlorophenol	ND	ND	ND	ND	10	—	—
2,4-dichlorophenol	ND	ND	ND	ND	10	—	—
2,4-dimethylphenol	ND	ND	ND	ND	10	—	—
2,4-dinitrophenol	ND	ND	ND	ND	50	—	—
2-methyl-4,6-dinitrophenol	ND	ND	ND	ND	50	—	—
2-nitrophenol	ND	ND	ND	ND	10	—	—
4-nitrophenol	ND	ND	ND	ND	50	—	—
Pentachlorophenol	ND	ND	ND	ND	100	—	—
Phenol	ND	ND	ND	ND	10	—	—
2,4,6-trichlorophenol	ND	ND	ND	ND	10	—	—
PAHs (µg/kg)							
Acenaphthene	ND	ND	ND	ND	20	16	500
Acenaphthylene	ND	ND	ND	ND	20	44	640
Anthracene	38.7	ND	ND	ND	20	85.3	1,100
Benz(a)anthracene	53.3	ND	ND	ND	20	261	1,600
Benzo(a)pyrene	84.7	ND	ND	ND	20	430	1,600
Benzo(b)fluoranthene	74.7	ND	ND	ND	20	—	—
Benzo(g,h,i)perylene	66.7	ND	ND	ND	20	—	—
Benzo(k)fluoranthene	50.8	ND	ND	ND	20	—	—

(table continues)

Table 2-5 (continued)

Analyte/Unit[a]	Site D Turning Basin	Reference	Control	*Rhepoxynius* Control	Detection Limit[b]	ERL	ERM
Chrysene	65.5	ND	ND	ND	20	384	2,800
Dibenz(a,h)anthracene	ND	ND	ND	ND	20	63.4	260
Fluoranthene	50.0	ND	ND	ND	20	600	5,100
Fluorene	ND	ND	ND	ND	20	19	540
Indeno(1,2,3-c,d)pyrene	50.8	ND	ND	ND	20	—	—
Naphthalene	ND	ND	ND	ND	20	160	2,100
Phenanthrene	ND	ND	ND	ND	20	240	1,500
Pyrene	51.3	ND	ND	ND	20	665	2,600
Total PAHs	586.5	0	0	0	NA	—	—

Source:
MEC 1992

Notes:
[a] all chemical analyses are given as dry-weight basis unless noted
[b] detection limits are given as wet-weight basis since the dry-weight values are arithmetically derived
[c] dash indicates not published

Acronyms/Abbreviations:
alpha-BHC – alpha isomer of benzene hexachloride
beta-BHC – beta isomer of benzene hexachloride
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
delta-BHC – delta isomer of benzene hexachloride
ERL – effects-range low
ERM – effects-range median
gamma-BHC – gamma isomer of benzene hexachloride
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
NA – not applicable
ND – not detected
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
TRPH – total recoverable petroleum hydrocarbons

Table 2-6
Solid-Phase Bioassay Test Results at
United States Navy Aircraft Carrier Turning Basin

	Polychaete Worm (*Nephtys caecoides)* Percent Survival	Mysid (*Holmesimysis costata)* Percent Survival	Amphipod (*Rhepoxynius abronius*) Percent Survival	Amphipod (*Rhepoxynius abronius*) Percent Reburial
Control	100	94	96	99
Reference	97.5	97	65	83.3
Turning Basin – Site D	95.0	80.0*	38*	89.6

Source
MEC 1992

Note:
* indicates statistically significant difference from the reference

Table 2-7
Summary of Significant Bioaccumulation at
United States Navy Aircraft Carrier Turning Basin Tissue Burden

Site	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	PAHs (µg/kg)	Total Pesticide (µg/kg)	Phenols (µg/kg)
Marine Clam (*Macoma nasuta*)													
Reference	14.42	0.61	3.62	9.70	2.49	0.363	6.46	1.22	0.67	79.1	ND	ND	ND
Turning Basin – Site D	15.11	0.16	4.18*	10.53*	3.35*	0.338	4.56	1.28	0.61	85.4*	ND	ND	ND
Polychaete Worm (*Nephtys caecoides*)													
Reference	11.57	1.16	2.48	12.82	1.51	0.279	2.95	1.69	1.13	144.4	ND	ND	ND
Turning Basin – Site D	25.72*	0.83	2.88*	13.62	1.62	0.271	4.76*	1.99*	1.14*	174.0*	ND	ND	ND

Note:
* statistically significant

Acronyms/Abbreviations:
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
ND – not detected
PAH – polynuclear aromatic hydrocarbon

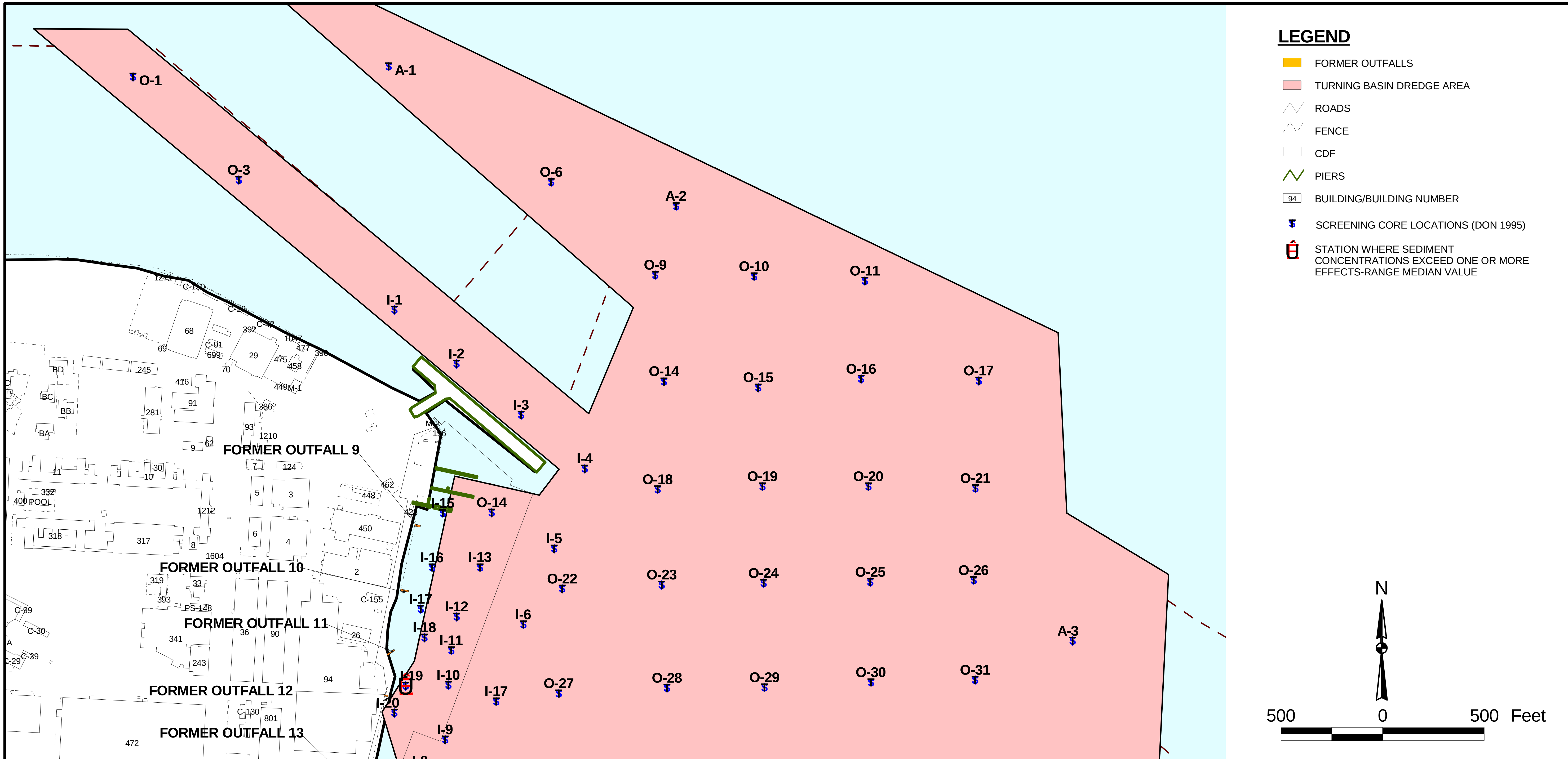
2.5 SEDIMENT CHARACTERIZATION

In 1993 and 1994, the DON conducted site-specific investigations to characterize sediment being proposed for dredging and disposal. The sediment characterization study was a two-part screening effort. The initial screening was to identify sediments suitable for beach replenishment, while the second screening evaluated unsuitable beach replenishment sediments for potential ocean disposal. The results of the characterization study augmented existing information and provided the data necessary to evaluate the suitability of sediment disposal (DON 1995b).

The initial sediment screening study consisted of the collection and analyses of 57 sediment core samples (Figure 2-4). This initial screening included the use of solid-phase bioassays (using amphipods), grain size, total organic carbon, and chemical analyses to assess the overall sediment quality and evaluate the suitability of these sediments for beach replenishment. Amphipod toxicity was observed in 8 of the 57 sites (I-17, I-19, O-9, O-11, O-25, O-26, O-30, and O-34). It was suspected that these results may have been false positives because the grain size was suitable for beach replenishment (i.e., 80 percent sand and gravel). Therefore, chemical analyses were conducted on the sediments from these eight sites. Mercury was observed in four of the eight sediment cores at concentrations slightly above the ERL of 0.15 milligram per kilogram (mg/kg). Total PCB core samples at Site I-19 were reported at a concentration of 1.313 mg/kg, approximately three times the ERM of 0.40 mg/kg (DON 1995b). The results of the sediment chemistry are presented in Table 2-8.

The areas identified in the initial screening as unsuitable for use as beach replenishment were grouped into five sites, which were tested and sampled for possible ocean disposal (Figure 2-5). Sediment characterization included chemical and physical analyses of the proposed dredged materials, suspended particulate bioassays, solid-phase bioassays, and bioaccumulation tests using seven different marine species.

Of the five sites, only Site 5 (quay wall) showed statistically significant toxicity in the solid-phase polychaete worm bioassay test (DON 1995b). On the basis of the three solid-phase bioassay results, sediments from Site 5 were designated unsuitable for ocean disposal. To localize contamination and evaluate the sediment for in-bay fill disposal, Site 5 was subdivided into four equal areas (5-1, 5-2, 5-3, and 5-4) for additional sampling and characterization. These sediments were analyzed for the same parameters as the first ocean disposal study (chemical and physical analyses, suspended particulate bioassays, solid-phase bioassays, and bioaccumulation). The sediment results identified statistically significant toxicity in subareas 5-1, 5-2, and 5-3 (DON 1995b). Sediment sampled from subarea 5-3 exceeded the ERM for total PCBs. The solid-phase bioassay test results and sediment chemistry results for Site 5 are presented in Tables 2-9 and 2-10, respectively.



Site 1 TCRA Closeout Report

Figure 2-4

Sediment Screening Sampling from Sediment Characterization Study

NAS North Island, San Diego, California

Bechtel National, Inc.
CLEAN II Program

Date: 10/4/01
File No.: 148L7806
Job No.: 22214-148
Rev No.: A

Table 2-8
Sediment Chemistry Results – Initial Screening
(in dry weight)

Analyte[a]/Unit	I-17	I-19	O-9	O-11	O-25	O-26	O-30	O-34	GUIDELINE VALUES NOAA ERL	NOAA ERM
Percent moisture (%)	23.8	17.1	22	25.3	28.0	25.5	18.5	26.4	—[b]	—
Ammonia (mg/kg)	7.0	7.3	5.8	2.5	6.7	4.5	2.5	6.6	—	—
Petroleum hydrocarbons (TRPH) (mg/kg)	130	24	100	25	130	190	16	200	—	—
Sulfide (mg/kg)	4.8	2.6	4.2	7.1	30	38.3	0.86	30	—	—
Dissolved sulfide (mg/kg)	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	—	—
Total organic carbon (%)	0.34	0.18	0.87	0.16	0.63	0.76	0.11	0.76	—	—
Metals (mg/kg)										
Silver	< 0.10	< 0.10	0.29	01.0	0.27	0.26	< 0.10	0.12	1	3.7
Arsenic	1.4	0.8	2.5	3.4	3.8	3.8	2.0	2.3	8.2	70
Cadmium	0.59	< 0.10	0.16	< 0.10	0.12	0.29	< 0.10	0.23	1.2	9.6
Chromium	16.4	10.5	12.7	9.8	13.9	16.2	10.3	15.9	81	370
Copper	11.5	5.7	18.7	7.6	26.5	27.3	5.5	22.3	84	270
Lead	11.7	3.5	13.0	4.0	23.0	23.4	4.8	15.1	47	218
Mercury	0.13	0.02	0.16	0.06	0.19	0.22	0.02	0.15	0.15	0.7
Nickel	2.85	2.05	3.44	3.89	3.42	4.06	4.07	4.08	21	52
Selenium	< 0.1[c]	< 0.1[c]	< 0.2[c]	< 0.3[c]	< 0.3[c]	< 0.2[c]	< 0.2[c]	< 0.2[c]	—	—
Zinc	33.8	13.4	43.8	23.1	56.1	61.9	22.3	50.1	150	410
Organotins (µg/kg)										
Monobutyltin	< 1.0	< 1.0	< 1.0	< 1.0	11	4	< 1.0	4	—	—
Dibutyltin	38	12	55	8	57	75	5	61	—	—
Tributyltin	35	63	57	59	45	55	53	42	—	—

(table continues)

Table 2-8 (continued)

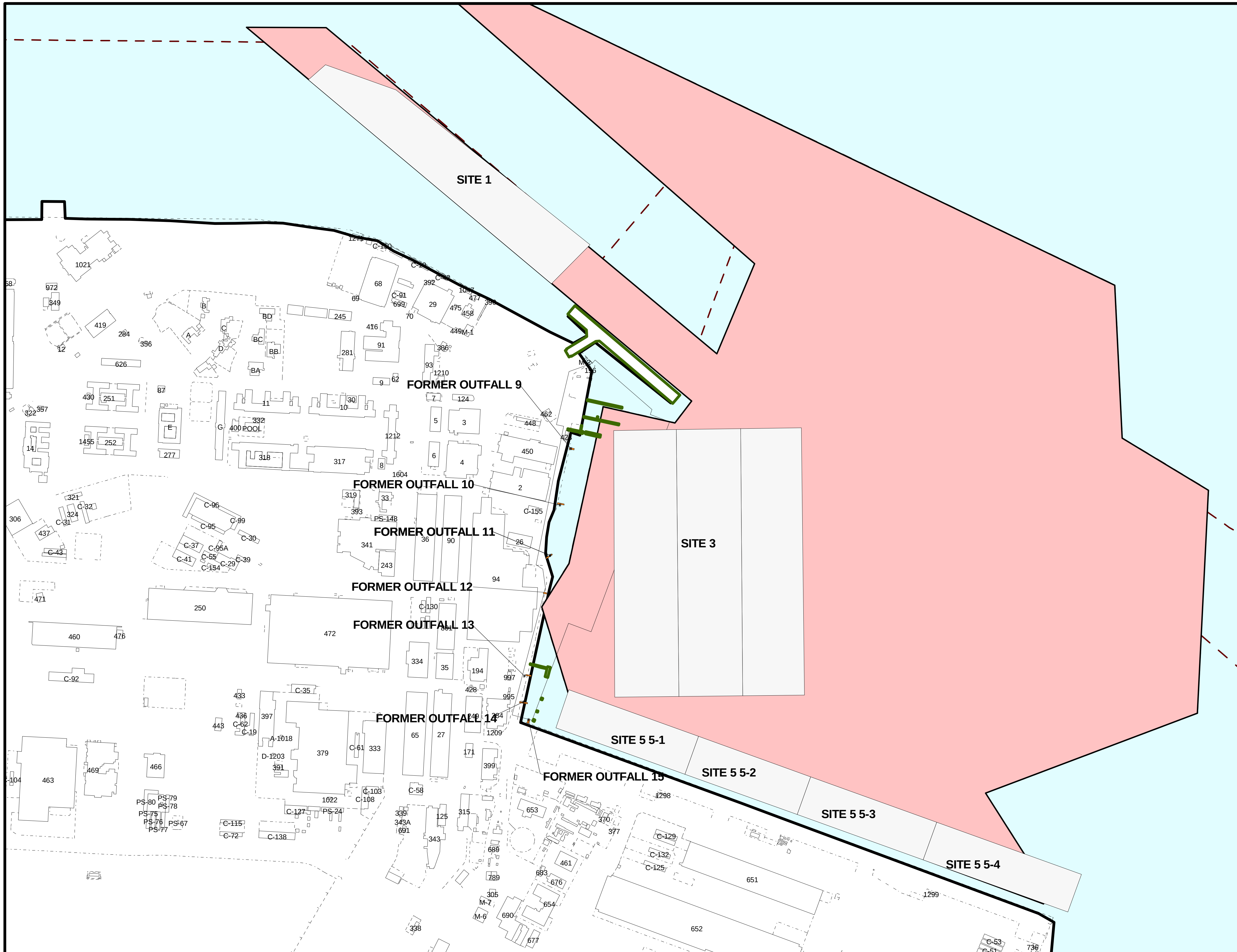
Analyte[a]/Unit	I-17	I-19	O-9	O-11	O-25	O-26	O-30	O-34	GUIDELINE VALUES NOAA ERL	NOAA ERM
Volatile Organic Compounds[d] (mg/kg)										
Benzene	< 0.033	< 0.030	< 0.032	< 0.033	< 0.035	< 0.034	< 0.031	< 0.034	—	—
Chloroform	< 0.013	< 0.120	< 0.013	< 0.013	< 0.014	< 0.013	< 0.012	< 0.014	—	—
Methylene chloride[e]	0.028	0.064	0.05	0.035	0.031	0.021	0.017	0.023	—	—
Toluene	< 0.033	< 0.030	< 0.032	< 0.033	< 0.035	< 0.034	< 0.031	< 0.034	—	—
Other semivolatiles[f] (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	—	—
Total phenols (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	—	—
Total PAHs (mg/kg)	0.574	0.396	0.553	0.457	1.723	0.786	0.396	0.587	4.022	44.792
Total PCBs (mg/kg)	ND	**1.313**[g]	ND	ND	ND	ND	ND	ND	0.0227	0.18
Total pesticides (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	—	—
Halomethanes (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	—	—

Source: DON 1995b

Notes:
- [a] totals for reported analytes include measured values plus one-half of the detection limit of nondetected analytes
- [b] dash indicates not available
- [c] reported value was determined by method of standard additions
- [d] samples analyzed for halogenated organic compounds (U.S. EPA Method 8010) and aromatic volatile organics (U.S. EPA Method 8020)
- [e] analyte is a suspected lab contaminant
- [f] other semivolatiles include 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and hexachlorobenzene
- [g] bold value is above ERM value

Acronyms/Abbreviations:

ERL – effects-range low
ERM – effects-range median
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
ND – value less than detection limit
NOAA – National Oceanic and Atmospheric Administration
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
TRPH – total recoverable petroleum hydrocarbons



Site 1 TCRA Closeout Report

Figure 2-5

Ocean Disposal Test Areas from Sediment Characterization Study

NAS North Island, San Diego, California

Bechtel National, Inc.
CLEAN II Program

Date: 10/4/01
File No.: 148L7807
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Table 2-9
Sediment Characterization Ocean Disposal
Site 5, Quay Wall Study
Solid-Phase Bioassay Results – Average Percent Survival

	SITE 5-1		SITE 5-2		SITE 5-3		SITE 5-4	
Sediment Type	**Survival**	**Reburial**	**Survival**	**Reburial**	**Survival**	**Reburial**	**Survival**	**Reburial**
Amphipod Results Summary								
Control	97	99	97	99	97	99	97	99
Reference	93	100	93	100	93	100	93	100
Site sediment	65*	100	85	99	58*	100	84	100
Mysid Results Summary								
Control	91		91		91		91	
Reference	93		93		93		93	
Site sediment	89		83		87		84	
Worm Results Summary								
Control	90		90		90		90	
Reference	86		86		86		86	
Site sediment	75		44*		71*		84	

Source:
DON 1995b

Note:
* indicates survival significantly less than reference at $p \leq 0.05$

Table 2-10
Sediment Characterization – Ocean Disposal Study
Sediment Chemistry Results – Site 5, Quay Wall Study
(in dry weight)

						GUIDELINE VALUES	
Analyte[a]/Unit	**Reference**	**Site 5-1**	**Site 5-2**	**Site 5-3**	**Site 5-4**	**NOAA ERL**	**NOAA ERM**
Percent moisture (%)	39	30	33	30	29	—[b]	—
Ammonia (mg/kg)	10.7	23.0	27.7	16.4	10.6	—	—
Petroleum hydrocarbons (TRPH) (mg/kg)	13.0	530	790	470	690	—	—
Sulfide (mg/kg)	7.2	263	324	140	41.0	—	—
Dissolved sulfide (mg/kg)	< 0.2	< 0.2	< 0.2	0.4	< 0.2	—	—
Total organic carbon (%)	1.20	0.72	0.82	0.81	0.98	—	—
Metals (mg/kg)							
Arsenic	3.2	3.7	4.8	4.5	6.5	8.2	70
Cadmium	0.1	0.4	0.6	0.4	0.4	1.2	9.6
Chromium	21.5	24.6	30.0	28.7	32.3	81	370
Copper	10.8	48.9	51.6	89.5	56.7	34	270
Lead	4.1	26.1	35.4	29.9	43.3	46.7	218
Mercury	0.03	0.36	0.18	0.23	0.18	0.15	0.71
Nickel	11.4	5.9	8.8	6.6	11.9	20.9	51.6
Selenium	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	—	—
Silver	0.2	0.9	1.1	0.9	0.9	1	3.7
Zinc	40.5	94.3	119	170	98.0	150	410
Organotins (μg/kg)							
Monobutyltin	< 1.6	< 1.4	< 1.5	< 1.4	< 1.4	—	—
Dibutyltin	< 1.6	1.6	3.6	< 1.4	< 1.4	—	—
Tributyltin	< 1.6	12.3	22.4	1.9	2.5	—	—

(table continues)

Table 2-10 (continued)

Analyte[a]/Unit	Reference	Site 5-1	Site 5-2	Site 5-3	Site 5-4	GUIDELINE VALUES NOAA ERL	NOAA ERM
Other semivolatiles[c] (mg/kg)	ND	ND	ND	ND	ND	ND	ND
Total PAHs (mg/kg)	0.060	0.550	0.590	2.690	1.190	4.022	44.792
Total pesticides	ND	ND	ND	ND	ND	ND	ND
Total PCBs (mg/kg)	0.098	0.140	0.160	**0.460**[d]	0.139	0.0227	0.18
Total phthalates (mg/kg)	ND	ND	ND	ND	ND	ND	ND
Total phenols (mg/kg)	ND	ND	ND	ND	ND	ND	ND

Source:
DON 1995b

Notes:
[a] totals for reported analytes include measured values plus one-half of the detection limit of nondetected analytes
[b] dash indicates not available
[c] other semivolatiles include 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and hexachlorobenzene
[d] bold value above ERM guidelines

Acronyms/Abbreviations:
ERL – effects-range low
ERM – effects-range median
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
ND – value less than detection limit
NOAA – National Oceanic and Atmospheric Administration
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
TRPH – total recoverable petroleum hydrocarbons

Section 3
ACTION MEMORANDUM

On 23 October 1995, the DON issued an Action Memorandum for a TCRA of Site 1, Outfalls 9–15, Shoreline Sediments (SWDIV 1995). The Action Memorandum documented, for the Administrative Record, the DON's decision to undertake a TCRA for IR Site 1, Outfalls 9-15, shoreline sediments. The Action Memorandum is summarized in the following sections.

3.1 RISK EVALUATIONS

A formal risk evaluation was not performed for the Site 1 Action Memorandum. However, the maximum concentration of contaminants previously detected was compared to the U.S. EPA Region 9 second-half 1995 industrial preliminary remediation goals. The results of this exercise indicated that the excess cancer risk for Site 1, Outfalls 9–15 was between 10^{-6} and 10^{-4}, equating to 1 in 10,000 and 1 in 1 million, respectively.

In addition, the maximum concentrations of chemicals detected in sediments were compared to the ERL values. This comparison was performed to assess whether chemical contamination in the Site 1 sediments could potentially pose a threat to nearby sensitive environments. Concentrations of seven metals and seven PAHs exceeded the ERL values, implying that potential existed for adverse health impacts to occur in organisms dwelling in the Site 1 sediments.

Because of the nature of these risks, a recommendation was made to isolate the contaminated sediment to mitigate potential environmental and health threats.

3.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Potential applicable or relevant and appropriate requirements (ARARs) identified in the Action Memorandum are listed below:

- **Federal Chemical-Specific ARARs** – substantive portions of Sections 303, 303, 401, and 404 of the federal Clean Water Act (CWA) (33 *United States Code* [USC] 1251 et seq.)
- **State Chemical-Specific ARARs** – substantive provisions of Sections 13241, 13243, 13263(a), and 13360 of the Porter-Cologne Water Quality Act as implemented through beneficial uses and water quality objectives of the Water Quality Control Plan for the San Diego Basin
- **Federal Location-Specific ARARs**
  - substantive portions of Section 307 of the federal Coastal Zone Management Act
  - Endangered Species Act of 1973
  - Migratory Bird Treaty Act of 1972

- **State Location-Specific ARARs**
  - California Endangered Species Act set forth in Fish and Game Code Sections 2050 through 2068, 2070, 2080, and 2090 through 2096
  - substantive requirements of the California Coastal Act of 1976 related to a consistency determination
- **Federal Action-Specific ARARs**
  - substantive provisions of Section 10 of the Rivers and Harbors Act of 1980
  - substantive requirements of Section 404 of the federal CWA (33 USC 1251 et seq.)
- **State Action -Specific ARARs** – action-specific ARARs that overlap chemical-specific ARARs as discussed under State and Federal Chemical-Specific ARARs

After the Action Memorandum was issued, dredging and disposal permits were obtained from the USACE and U.S. EPA for the dredge and fill activities associated with Military Construction Project P-549. Although these permits were not necessary for the completion of the TCRA, the DON chose to include the substantive portion of the permit requirements as ARARs for this TCRA. These permits are listed below and discussed further in Section 4:

- RWQCB Order No. 95-118, Waste Discharge Requirements for the U.S. Navy Dredge and Fill Activities Homeporting Project San Diego County (RWQCB 1995)
- USACE Permit No. 94-20861-DZ for San Diego Bay, Imperial Beach, Mission Beach, Del Mar, Oceanside, and the LA-5 Ocean Disposal Site, San Diego County, California; and modification (USACE 1996)

3.3 TIME-CRITICAL REMOVAL ACTION OBJECTIVES

The removal action for Site 1 was selected to reduce the possibility that ecological and human receptors could be exposed to contaminants present in shoreline sediments in the current industrial scenario. The removal action objectives at IR Site 1 were:

- to prevent exposure of human and ecological receptors to metals and SVOCs in sediments
- to prevent probable contaminant migration pathways, including bay sediment dispersion, wind dispersion of contaminated beach sediment, and surface runoff

3.4 STATE AND LOCAL ACTIONS

As previously mentioned, Federal Executive Order 12580 delegates to the Department of Defense the President's authority to undertake CERCLA response actions. Congress further outlined this authority in its Defense Environmental Restoration Program Amendments, which can be found at 10 USC Sections 2701–2705. Both CERCLA

Section 120(f) and 10 USC Section 2705 require the DON facilities to assure that state and local officials be given the timely opportunity to review and comment on the DON response actions. CERCLA Section 120 further requires the DON to apply state removal and remedial action law requirements at its facilities when such facilities are not included in the National Priorities List. In addition, this TCRA complied with provisions for the conduct of interim measures as outlined in the State Hazardous Waste Facility Permit (U.S. EPA ID Number CA 7170090016) of 21 December 1989.

Accordingly, the DTSC and the RWQCB provided technical advice, oversight, and assistance with planning and review during this removal action.

3.5 SELECTED ALTERNATIVE

Five alternatives as well as the no action alternative were evaluated for Site 1, Outfalls 9–15 sediment removal action. The selected alternative is discussed in the following section. The area encompassed by this removal action was approximately 13.4 acres, trapezoidal in shape, and approximately 200 feet wide at the southern end at the quay wall and 550 feet wide at the northern end at Pier J/K.

Alternative 1 was the selected alternative on the basis of constructability, effectiveness, implementability, and cost. Alternative 1 takes advantage of the military construction project associated with the planned homeporting of one Nimitz-class aircraft carrier (DON 1995a). This project consisted of the dredging of a turning basin, construction of a rock dike, construction of a 13.4-acre fill area behind the rock dike, and creation of a 14-acre mitigation area. Additional activities conducted under the homeporting project include construction of a wharf and associated support facilities and dredging of the main San Diego Bay ship channel. The rock dike and fill area (now known as the CDF) were designed to enclose the *in situ* Site 1 sediment and the dredged-fill sediment, thus preventing direct human and ecological contact and reducing the perceived risk presented by metals and SVOCs in the sediment.

3.6 PUBLIC INFORMATION/COMMUNITY RELATIONS

As the lead federal agency, the DON initiated a community relations effort in coordination with the DTSC (the lead state agency) to solicit community input and keep the community informed of the status of the proposed actions. A Restoration Advisory Board (RAB) has been established at NAS North Island to allow a wider range of community involvement. The RAB broadens the focus for community input and participation in all aspects of the NAS North Island IR Program activities. The RAB was informed of the decision to conduct this TCRA at a regularly scheduled meeting on 09 November 1995.

The Action Memorandum was made available to the public for review and comment through the Administrative Record as provided under 40 *Code of Federal Regulations* (CFR) Section 300.415(m) and 300.820.

3.7 COSTS

The vast majority of costs related to the removal action was funded by the DON's planned homeporting of one Nimitz-class aircraft carrier at NAS North Island. The only costs associated with the removal funded by the DON's Defense Environmental Restoration Account were those associated with preparing the Action Memorandum and this Closeout Report and postconstruction monitoring. Estimated costs for these tasks are as follows:

- Action Memorandum $36,000
- TCRA Closeout Report $69,000
- Postconstruction Monitoring $1,378,000

Section 4
PERMITTING REQUIREMENTS AND ADDITIONAL TESTING

As indicated in Section 121(e)(1) of CERCLA and the corresponding provision in the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Section 300.400[e][1]), permits are not required for CERCLA removal actions that are conducted entirely on-site. This TCRA met these requirements; therefore, no permits were required. However, dredging and disposal permits from the USACE and U.S. EPA were independently required for the associated dredge and fill activities (e.g., ship channel dredging and waste disposal). The DON chose to include the substantive portion of the dredge and fill permit requirements as ARARs for this TCRA. The requirements of the dredge and fill permits are summarized in the following sections. Sediment characterization, in addition to that discussed in Section 2, was required to comply with RWQCB Order No. 95-118. This work is also discussed in the following sections.

4.1 RWQCB AND USACE REQUIREMENTS

In 1995, RWQCB issued Order No. 95-118, Waste Discharge Requirements for the U.S. Navy Dredge and Fill Activities Homeporting Project, San Diego County (RWQCB 1995). The order required the submittal of a dredge operation plan and details of the required monitoring to be performed during dredging operations.

Additional requirements of the RWQCB order included the submittal of a proposal for an ongoing water quality program to monitor site conditions and quay wall construction in an effort to prevent migration of chemicals of concern (COCs) into San Diego Bay. A plan for postclosure maintenance of the quay wall site was also required.

In 1996, USACE issued Permit No. 94-20861-DZ for San Diego Bay, Imperial Beach, Mission Beach, Del Mar, Oceanside, and the LA-5 Ocean Disposal Site, San Diego County, California, and modification (USACE 1996). A requirement of the USACE permit was to submit a plan for monitoring the concentrations and solubility of the COCs in the dredged-fill material and effectiveness of the CDF in preventing migration of contaminants into San Diego Bay or groundwater sources.

Construction monitoring during the dredging operation is also outlined in the USACE and RWQCB permits. Dredging and construction activities were conducted in accordance with permit specifications to control turbidity and water column contaminants. In accordance with the permits, water sampling and testing results were submitted to the RWQCB as the data were processed. There were no instances of noncompliance during removal or placement of the material within the CDF (Moffatt & Nichol Engineers 1999).

4.2 ADDITIONAL TESTING

Additional sediment characterization was required to comply with RWQCB Order No. 95-118. This work is summarized in the following sections.

4.2.1 Predredge Monitoring Report

Samples of sediment classified as unsuitable for ocean disposal from the quay wall (samples Q-1 through Q-14), Site 1 (samples IR-1 through IR-10), and along the proposed rock dike footing (samples D-1 through D-5) were analyzed for arsenic, cadmium, total chromium, copper, lead, mercury, nickel, silver, zinc, organotins, and PAHs using U.S. EPA Method 1312, Synthetic Precipitation Leaching Procedure (SPLP), modified for analyses of marine sediments (DON 1996a). This method was used to assess the potential leachability of contaminants from these sediments. Figure 4-1 shows the predredge sampling locations.

Results of these analyses indicated that the sediment from the quay wall, Site 1, and the rock dike footing contained reportable levels of arsenic, tributyltin, and five PAHs (anthracene, chrysene, fluorene, phenanthrene, and pyrene) that could potentially leach into water (DON 1996a). This determination was made by multiplying the SPLP concentrations by 20 to account for dilution (per RWQCB) and comparing the resultant concentration to the numerical water quality objectives (NWQOs) for the protection of human health contained in the California Ocean Plan. The predredge analytical results are summarized in Table 4-1. The SPLP results (after accounting for dilution) were compared with the National Ambient Water Quality Criteria. This comparison found exceedances at one or more stations for arsenic, tributyltin, chrysene, and phenanthrene. The stations with exceedances are shown on Figure 4-1.

4.2.2 Supplement to Predredge Monitoring Report

The RWQCB review of the Predredge Monitoring Report included the above-mentioned comparison of the sediment results to the NWQOs for the protection of human health contained in the California Ocean Plan. On the basis of this comparison, RWQCB classified the quay wall sediments (the dredged-fill sediments) as nonhazardous-designated waste. The classification is based on Title 23 of the CCR, Division 3, Chapter 15, which defines a “designated waste” as “a waste that contains pollutants which, under ambient environmental conditions, could be released in concentrations in excess of applicable water quality objectives, or which could cause degradation of waters of the state.” The RWQCB review included a statement that the DON could demonstrate that “the waste poses a lower risk to degrading the water quality at the site than its classification suggests” (DON 1996b).

A supplemental report was developed to present a more definitive assessment of the sediments using data from the Predredge Monitoring Report. Both theoretical and empirical evaluations were conducted and presented in the supplemental report to satisfy the requirements of RWQCB Order No. 95-118. The evaluations indicated that the dredged-fill and in situ Site 1 sediments posed no threats to water quality.

LEGEND

- SEDIMENT CORE - U.S. DON 1996
- FORMER OUTFALLS
- TURNING BASIN DREDGE AREA
- ROADS
- FENCE
- CDF
- PIERS
- 94 BUILDING/BUILDING NUMBER
- STATION WHERE SPLP CONCENTRATION EXCEEDS ONE OR MORE NATIONAL AMBIENT WATER QUALITY CRITERIA OR CALIFORNIA ENCLOSED BAY AND ESTUARIES NATIONAL WATER QUALITY OBJECTIVE AFTER MULTIPLED BY 20 TO ACCOUNT FOR DILUTION PER RWQCB (US DON 1996b)

N

300 0 300 Feet

Site 1 TCRA Closeout Report

Figure 4-1

Pre-Dredge Monitoring Sampling Locations

NAS North Island, San Diego, California

Bechtel National, Inc.

CLEAN II Program

Date: 9/26/01
File No.: 148L7808
Job No.: 22214-148
Rev No.: A

Table 4-1
SPLP Analytical Results, Predredge Monitoring Report

		QUAY WALL SITES													
Analyte	**Site Water**	**Q-1**	**Q-2**	**Q-3**	**Q-4**	**Q-5**	**Q-6**	**Q-7**	**Q-8**	**Q-9**	**Q-10**	**Q-11**	**Q-12**	**Q-13**	**Q-14**
Metals (mg/L)															
Silver	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic	< 0.02	**0.02***	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	**0.02**	< 0.02	**0.03**	**0.02**	**0.02**
Cadmium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Chromium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Copper	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Mercury	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Nickel	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Lead	< 0.02	< 0.02	< 0.02	< 0.03	< 0.02	< 0.02	< 0.03	< 0.02	< 0.02	< 0.02	< 0.02	< 0.03	< 0.02	< 0.03	< 0.02
Zinc	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Polynuclear Aromatic Hydrocarbons (µg/L)															
Acenaphthene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.016**
Benz(a)anthracene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo(k)fluoranthene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.018**	**0.07**	**0.012**	< 0.01	< 0.01	< 0.01	**0.081**	< 0.01	**0.013**
Fluorene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	**0.025**
Indeno(1,2,3-c,d)pyrene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Naphthalene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.011**	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.02**
Pyrene	< 0.01	< 0.01	**0.019**	**0.051**	**0.038**	**0.048**	**0.12**	**0.10**	**0.027**	**0.024**	< 0.01	**0.034**	**0.12**	**0.082**	**0.073**
Organotins (µg/L)															
Dibutyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Monobutyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrabutyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tributyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.006**	**0.006**	**0.006**	**0.006**	< 0.0005	< 0.0005	**0.006**	**0.008**	**0.011**	**0.008**	**0.007**

(table continues)

Table 4-1 (continued)

Analyte	Site Water	IR-1	IR-2	IR-3	IR-4	IR-5	IR-6	IR-7	IR-8	IR-9	IR-10	Site Water	D-1	D-2	D-3	D-4	D-5
	INSTALLATION RESTORATION SITE 1											ROCK DIKE SITES					
Metals (mg/L)																	
Silver	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic	< 0.02	**0.04**	**0.04**	**0.03**	**0.02**	**0.02**	**0.03**	< 0.02	< 0.02	**0.03**	< 0.02	< 0.02	**0.03**	**0.03**	< 0.02	< 0.02	**0.02**
Cadmium	< 0.005	< 0.005	**0.007**	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Chromium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Copper	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Mercury	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Nickel	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Lead	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Zinc	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Polynuclear Aromatic Hydrocarbons (µg/L)																	
Acenaphthene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	**0.083**	< 0.05	< 0.05
Acenaphthylene	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Anthracene	< 0.01	< 0.01	< 0.01	**0.011**	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.035**	< 0.01	< 0.01
Benz(a)anthracene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo(k)fluoranthene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.017**	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	< 0.01	**0.02**	< 0.01	**0.056**	< 0.01	< 0.01	**0.012**	< 0.01	< 0.01	**0.011**	< 0.01	< 0.01	< 0.01	< 0.01	**0.062**	**0.012**	**0.047**
Fluorene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	**0.042**	< 0.02	< 0.02
Indeno(1,2,3-c,d)pyrene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Naphthalene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	< 0.01	< 0.01	< 0.01	**0.015**	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.064**	< 0.01	< 0.01
Pyrene	< 0.01	**0.037**	**0.076**	**0.058**	**0.18**	**0.046**	**0.011**	**0.012**	< 0.01	< 0.01	**0.012**	< 0.01	**0.038**	**0.015**	**0.27**	**0.014**	**0.099**
Organotins (µg/L)																	
Dibutyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Monobutyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrabutyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tributyltin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.008**	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005

Source:
DON 1996b

Note:
* bold values are those that were reported above the instrument detection limit

Acronyms/Abbreviations:
µg/L – micrograms per liter
mg/L – milligrams per liter
SPLP – synthetic precipitation leaching procedure

Calculations performed to predict the fate and transport of porewater within the CDF supported the assumption that during compaction of the CDF, the porewater from the sediment would move toward the bay rather than toward the adjacent land into the groundwater. Dr. Mike Palermo of the USACE Waterway Experiment Center conducted the calculations (the Palermo model), which indicate that porewater within the sediment at the CDF had the potential to move upward during compaction to 4.1 feet MLLW. This level is below that of the existing groundwater beneath the adjacent land but above mean sea level.

Evaluation of the diffusion process indicated that leachate from the quay wall/dredged-fill sediment could eventually mix with San Diego Bay water at approximately a 1:2,500 dilution (0.04 percent). The mixing zone is the area between the inner edge of the rock dike and the shoreline. For example, pyrene at a concentration of 1.12 micrograms per liter (μg/L) (the average concentration in the combined dredged-fill and *in situ* Site 1 sediment) would attenuate to a level of 0.0004 μg/L. This is 22 times below the California Ocean Plan NWQO for pyrene (0.0088 μg/L) under the most conservative conditions.

The Predredge Monitoring Report concluded that the sediment within the CDF "poses a lower risk to degrading the water quality at Site 1 than its original classification suggests." In addition, the sediment contained within the CDF (both dredged-fill and *in situ* Site 1) should be considered "inert" and not "designated" as RWQCB initially suggested. This conclusion was based on the demonstrated ability of the CDF to meet applicable water quality objectives as well as the reasonable expectation that beneficial uses of state waters will not be affected by the CDF sediment leachate.

Section 5
TCRA CONSTRUCTION ACTIVITIES

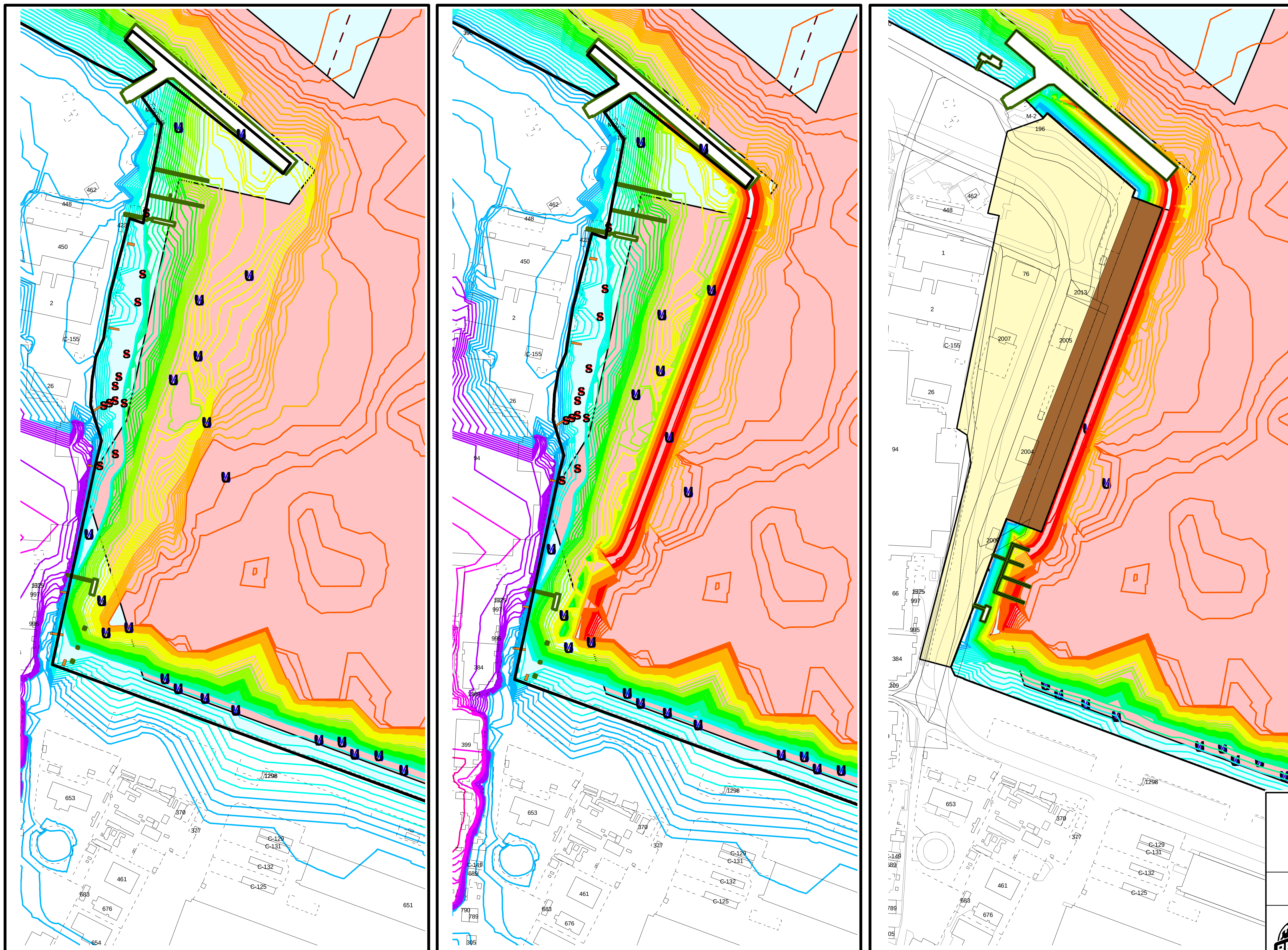
This construction project included dredging the turning basin and constructing a 13.4-acre fill area behind the rock dike. The dredged-fill sediment, identified as unsuitable for ocean disposal, was placed over *in situ* Site 1 sediment. Ten to 14 feet of clean fill was placed over the dredged-fill sediment (SWDIV 1995). The clean fill was also used to create the 50-foot buffer zone between the dredged-fill sediments and the rock dike. Figure 5-1 presents the area before and after the construction of the CDF. Figures 5-2 and 5-3 depict cross sections of the CDF.

Construction began in September 1996. The CDF fill and dikes were essentially complete as of March 1997. Densification of the newly created fill (backland) and armor stone placement was completed in June 1997. The site improvements, including utility construction and paving (impermeable layer), were completed in June 1998.

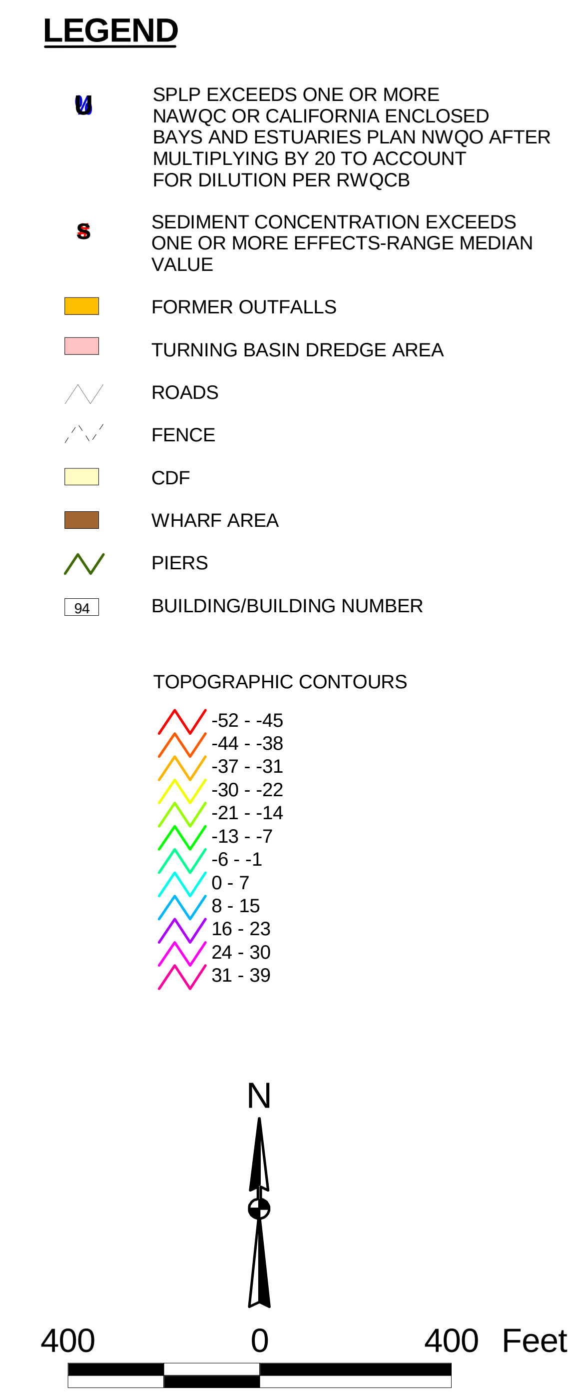
The CDF fill area is contained along the north, east, and west sides by dikes constructed of quarry run and armor stone. The dike structure is approximately 100 feet wide at the base and surrounds approximately 13.4 acres at mean high water. The rock containment dike placement accounted for design and operational conditions, including fill loads and seismic activity. The fill was made structurally and seismically competent; this precluded excessive amounts of fine-grained material (DON 1995a).

A multilift dike construction was used to minimize the amount of rock required. The multilift dike construction required approximately 250,000 tons of rock material that ranged in size from sandy to coarse (12-inch maximum) material. The rock matrix is a very dense mixture that provides an extremely effective filter barrier for the fill material. To further stabilize the dike, a foundation was constructed by excavating below the dike and filling with quarry rock material, which provides a structural attachment to the existing bearing material on the bay bottom. The stability of the fill landward of the dikes was improved by ground densification measures involving the use of stone columns. The rock material was brought in by barge. The dike lifts were placed on the fill progressing in 15-foot increments from the sea bottom to final grade at 10 feet MLLW. The exposed face was protected with approximately 21,000 tons of 500-pound armor stone. Fill material unsuitable for ocean disposal was confined within a portion of the first dike lift from sea bottom to –20 feet MLLW. Filter fabric was placed between the fill and armor underlayer in the tidal zone from –2 to +10 feet MLLW to prevent migration of fine material by tidal influence (DON 1995a).

Construction of the dike and fill area involved several operations: creation of a foundation trench for the northeast corner, construction of the first dike lift in the northeast corner, completion of the foundation trench for placement in the northeast corner, completion of the first dike lift, disposal of material from near the existing quay wall within the first lift, and then dike and fill from the mitigation area to bring the land surface to final grade. Approximately 78,000 cubic yards of material that was unsuitable for ocean disposal was deposited behind the diked area. The area was capped with clean sediment and capped with asphalt or concrete. Sediment volumes placed in the CDF as reported by Moffatt & Nichol are presented in Table 5-1.



AREA PRIOR TO CDF CONSTRUCTION AREA DURING CDF CONSTRUCTION AREA AFTER CDF CONSTRUCTION



Site 1 TCRA Closeout Report

Figure 5-1

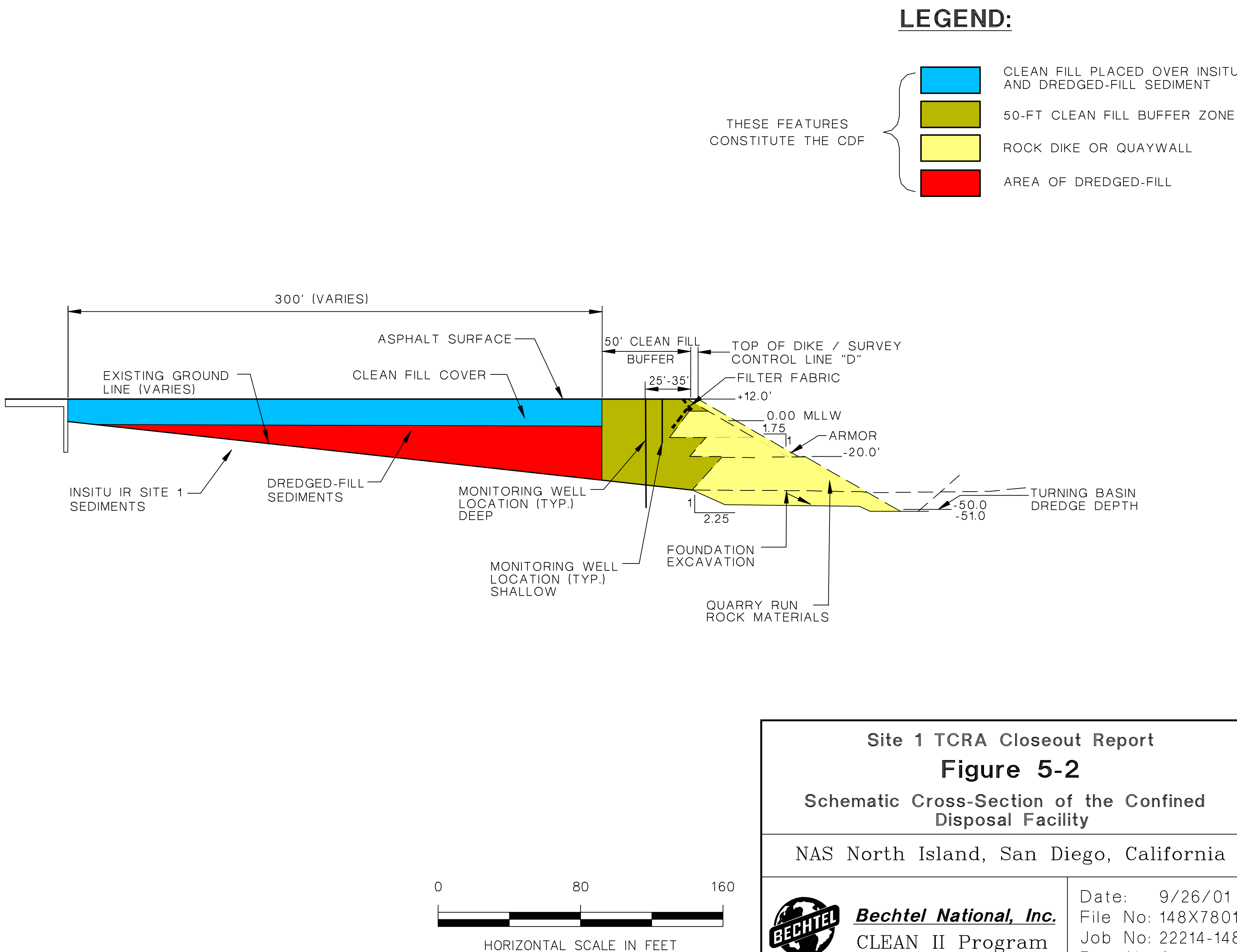
Site 1 Area Prior, During, and After CDF Construction

NAS North Island, San Diego, California

Bechtel National, Inc.

CLEAN II Program

Date: 9/26/01
File No.: 148L7800
Job No.: 22214-148
Rev No.: A



Site 1 TCRA Closeout Report

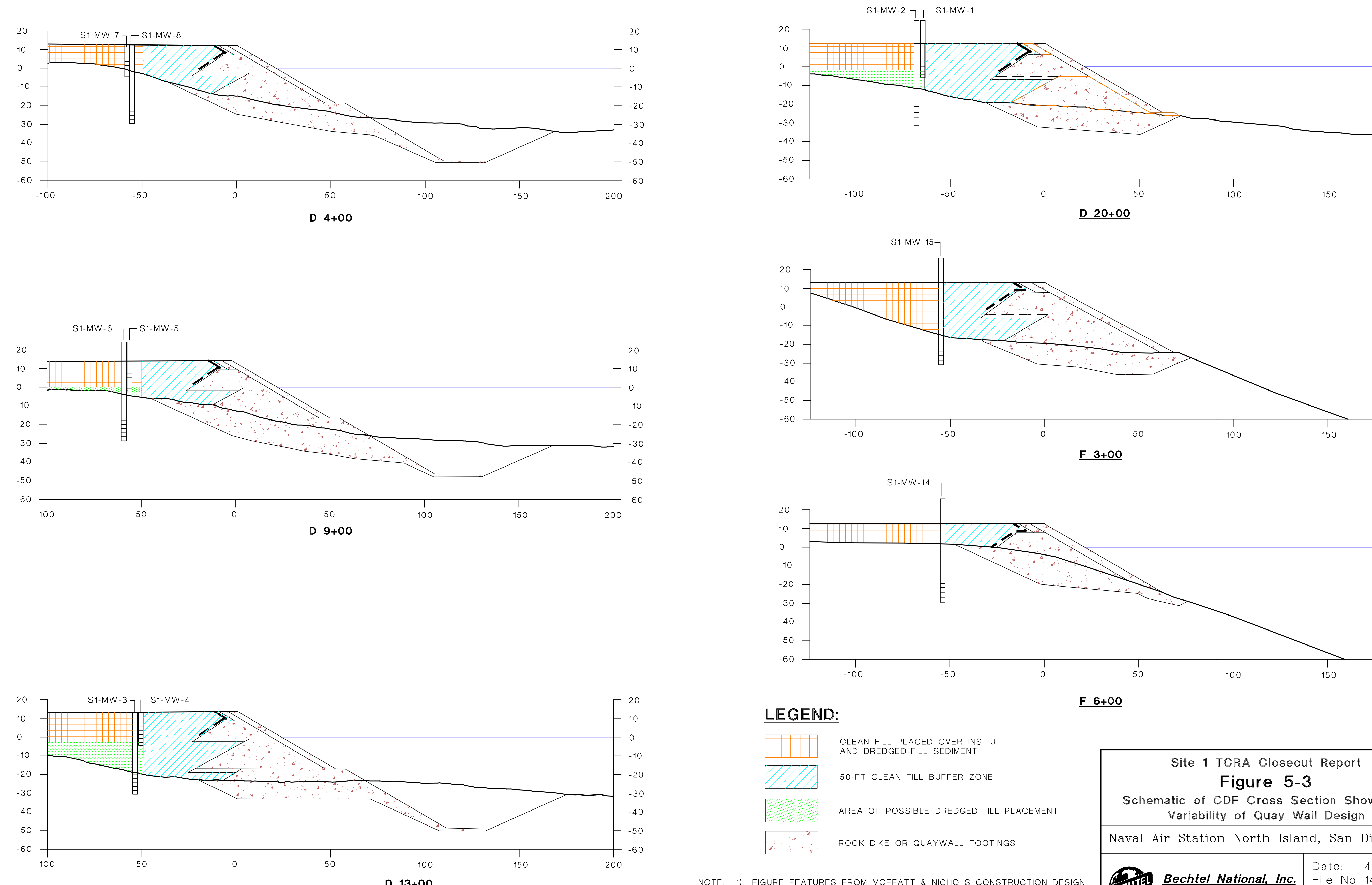
Figure 5-2

Schematic Cross-Section of the Confined Disposal Facility

NAS North Island, San Diego, California

Bechtel National, Inc.
CLEAN II Program

Date: 9/26/01
File No: 148X7801
Job No: 22214-148
Rev No: A



NOTE: 1) FIGURE FEATURES FROM MOFFATT & NICHOLS CONSTRUCTION DESIGN
2) WELLS ARE PROJECTED ONTO NEAREST SCHEMATIC CROSS SECTION

Site 1 TCRA Closeout Report

Figure 5-3

Schematic of CDF Cross Section Showing Variability of Quay Wall Design

Naval Air Station North Island, San Diego, CA

Bechtel National, Inc.
CLEAN II Program

Date: 4/8/02
File No: 148X8621
Job No: 22214-148
Rev No: A

Table 5-1
CDF Fill Sediment Volumes

Use	Volume (cubic yards)
50-foot buffer zone	65,545
Dredged-fill sediments (unsuitable for ocean disposal)	78,100
CDF fill sediments (excludes dredged-fill sediments)	28,557
Total	**172,202**

Source:
Moffatt & Nichol Engineers 1997

Acronym/Abbreviation:
CDF – confined disposal facility

Construction monitoring during the dredging operation is also outlined in the USACE and RWQCB permits. In accordance with the permits, water sampling and testing results were submitted to the RWQCB as the data were processed. There were no instances of noncompliance during removal or placement of the material within the CDF (Moffatt & Nichol Engineers 1999).

Section 6
CONCLUSIONS

The TCRA was completed in 1998 in accordance with the Action Memorandum (SWDIV 1995) and met its objectives to reduce the possibility that ecological and human receptors could be exposed to contaminants present in shoreline sediments in the current industrial scenario.

However, both RWQCB Order No. 95-118 and USACE Permit No. 94-20861-DZ required a water quality program be instituted to monitor the concentrations and solubility of the COCs in the dredged-fill material and to confirm whether the CDF effectively prevents migration of contaminants into San Diego Bay or groundwater sources. A plan for postclosure maintenance of the quay wall site was also required.

The Nearshore Confined Disposal Facility Post Dredge Monitoring Plan (Moffatt & Nichol Engineers 1999) issued in February 1999 meets the postclosure monitoring plan requirements set forth in the RWQCB and USACE permits. The California Coastal Commission approved the Nearshore Confined Disposal Facility Post Dredge Monitoring Plan in August 1999. In addition, a final Focused RI/RFI Work Plan for IR Site 1, Outfalls 9-15, Shoreline Sediments, was issued in 1998 (BNI 1998).

Both the Nearshore CDF Post Dredge Monitoring Plan (Moffatt & Nichol Engineers 1999) and the Focused RI/RFI Work Plan (BNI 1998) were developed and modified in accordance with regulatory comments from the DTSC and the RWQCB. The plans were also distributed to the potential stakeholders and made available to the RAB for review and comment.

The RI/RFI Work Plan describes the rationale proposed for the use of existing data, sample collection, and analytical methods to conduct a focused RI/RFI at Site 1, Outfalls 9–15. The objective of the focused RI/RFI is to evaluate potential risks to human health and/or the environment posed by the *in situ* Site 1 sediments and the dredged-fill sediments within the CDF and to confirm the effectiveness of the CDF as a final remedial solution. The RI/RFI is a focused investigation because the scope is limited to confirming the effectiveness of the selected remedy, the CDF, as implemented. The focused RI/RFI is scheduled for completion in 2003.

The feasibility study (FS)/corrective measures study (CMS) will assess the need for additional remedies at Site 1 on the basis of the findings of the focused RI/RFI. The FS/CMS is scheduled for completion in 2006.

Section 7
REFERENCES

Bechtel National, Inc. 1995. Final Engineering Evaluation/Cost Analysis Non-Time-Critical Removal Action for Installation Restoration Program Sites 9 and 11. Naval Air Station North Island, San Diego County, California. October.

———. 1998. Final Focused Remedial Investigation/ RCRA Facility Investigation Work Plan, IRP Site 1, Outfalls 9–15, Shoreline Sediments, Naval Air Station North Island, San Diego County, California. April.

———. 2000. Draft Site Management Plan, Naval Air Station North Island, Coronado, California. March.

BNI. *See* Bechtel National, Inc.

Brown and Caldwell. 1983. Initial Assessment Study. Naval Air Station North Island, Coronado, California. August.

California Regional Water Quality Control Board, San Diego Region. 1994. Water Quality Control Plan for the San Diego Basin (9). Approved by the Office of Administrative Law. 26 April.

———. 1995. Order No 95-118. Waste Discharge Requirements for the U.S. Navy Dredge and Fill Activities. Homeporting Project. San Diego County. 22 December.

Department of Health Services, Region 4, Facility Permitting Unit. 1989. RCRA Facility Assessment. Naval Air Station – North Island, San Diego, California. EPA ID Number CA7170090016. 18 April.

DHS. *See* Department of Health Services, Region 4, Facility Permitting Unit.

DON. *See* United States Department of the Navy.

Harding Lawson Associates. 1985. Draft Verification Study Report. Naval Air Station North Island, San Diego, California. 22 March.

———. 1989. Draft – Remedial Investigation Shoreside Sediments (Site 1), Volumes 1 and 2. Naval Air Station North Island, San Diego, California. 15 May.

HLA. *See* Harding Lawson Associates.

Huntley, D. 1999. Analysis of the Contribution of CDF Sediments to Mass Transport of Solutes to San Diego Bay, Naval Air Station North Island, IRP Site 1, Outfalls 9–15, Phase I – Laboratory and Field Studies. 16 February.

Jacobs Engineering Group Inc. 1991. Sites 1, 5, 6, 9, and 10 Draft Sampling and Analysis Plan. Naval Air Station North Island, San Diego, California. 14 October.

JEG. *See* Jacobs Engineering Group Inc.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management*. 19(1):81-97.

MEC. *See* MEC Analytical Systems, Inc.

MEC Analytical Systems, Inc. 1992. Results of Chemical, Physical, and Bioassay Analyses on Sediment from Bravo Pier and the Aircraft Carrier Turning Basin in San Diego Bay, California. 03 December.

Moffatt & Nichol Engineers. 1997. Correspondence from Alan Alcorn to DON. July.

———. 1999. Nearshore Confined Disposal Facility Post Dredge Monitoring Plan, CVN Homeporting Project. Naval Air Station North Island. Coronado, California. February.

RWQCB. *See* California Regional Water Quality Control Board.

Southwest Division Naval Facilities Engineering Command. 1995. Action Memorandum Time-Critical Removal Action for Installation Restoration Site 1, Naval Air Station North Island, San Diego County, California. October.

SWDIV. *See* Southwest Division Naval Facilities Engineering Command.

SWRCB. *See* California State Water Resources Control Board.

United States Army Corps of Engineers, Los Angeles District. 1996. Permit No. 94-20861-DZ for San Diego Bay, Imperial Beach, Mission Beach, Del Mar, Oceanside, and the LA-5 Ocean Disposal Site (LA-5), San Diego County, California.

United States Department of Agriculture, Forest Service. 1997. Ecological Subregions of California – Section and Subsection Descriptions. R5-EMTP-005. September.

United States Department of the Navy. 1995a. Final Environmental Impact Statement for the Development of Facilities in San Diego to Support the Homeporting of One Nimitz Class Aircraft Carrier. November.

———. 1995b. Sediment Characterization Report for the Nimitz Class Aircraft Carrier Homeporting Facilities, Naval Air Station, North Island, California, Volume 1, Sediment Characterization Results. February.

———. 1996a. Pre-Dredge Monitoring Report, CVN Homeporting Project, Naval Air Station North Island, Coronado, California. 17 April.

———. 1996b. Supplement to Pre-Dredge Monitoring Report, CVN Homeporting Project, Naval Air Station North Island, Coronado, California. 10 October.

———. 1999. San Diego Bay Integrated Natural Resources Management Plan and San Diego Unified Port District Public Draft. September.

United States Environmental Protection Agency/United States Army Corps of Engineers. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal. EPA-503/8-91/001. February.

USACE. *See* United States Army Corps of Engineers, Los Angeles District.

USDA. *See* United States Department of Agriculture, Forest Service.

U.S. EPA/USACE. *See* United States Environmental Protection Agency/United States Army Corps of Engineers.

WCC. *See* Woodward-Clyde Consultants.

Woodward-Clyde Consultants. 1994a. Seismic Hazards Assessment Proposed Nimitz Class Aircraft Carrier Homeporting Project, Naval Air Station North Island Coronado, California. May.

———. 1994b. Geotechnical Investigation Proposed Aircraft Carrier Wharf (P-700), Naval Air Station North Island Coronado, California. May.

APPENDIX A

RESPONSE TO REGULATOR COMMENTS ON DRAFT TCRA CLOSEOUT REPORT

2 April 2002

**FINAL RESPONSE TO DTSC COMMENTS ON
DRAFT TIME-CRITICAL REMOVAL ACTION CLOSEOUT REPORT FOR
IR SITE 1, OUTFALLS 9–15, SHORELINE SEDIMENTS,
NAVAL AIR STATION NORTH ISLAND
CTO-0148**

<table>
<tr><td colspan="2">Comments by:
Rafat Abbasi, P.E., Unit Chief
Federal Facilities Unit “B”, Office of Military Facilities,
Department of Toxic Substances Control, California Environmental Protection Agency
Dated 25 February 2002</td></tr>
<tr><td colspan="2">GENERAL COMMENTS</td></tr>
<tr><td>Comment 1:
Based on our review we do not have any comments on the report and agree that removal action objectives outlined in the Removal Action Work Plan have been met.</td><td>Response 1:
Comment noted. No response required.</td></tr>
</table>

**FINAL RESPONSE TO DTSC COMMENTS ON
DRAFT TIME-CRITICAL REMOVAL ACTION CLOSEOUT REPORT FOR
IR SITE 1, OUTFALLS 9–15, SHORELINE SEDIMENTS,
NAVAL AIR STATION NORTH ISLAND
CTO-0148**

<table>
<tr><td colspan="2">Comments by:
Marie T. McCrink, RG, Geologic Services Unit, Site Mitigation Branch,
Department of Toxic Substances Control, California Environmental Protection Agency
Dated 13 February 2002</td></tr>
<tr><td colspan="2">GENERAL COMMENTS</td></tr>
<tr><td>Comment 1:
The subject report provides a clear, concise summary of a long complicated project. From the hydrogeologic perspective, it appears that monitoring issues have been adequately addressed. The GSU will reserve final comment on the completeness of the characterization until the RI/RFI report is submitted and reviewed.</td><td>Response 1:
Comment noted. No response required.</td></tr>
<tr><td colspan="2">SPECIFIC COMMENTS</td></tr>
<tr><td>Comment 1: Section 6 – Conclusions
The third paragraph of this section discusses the Nearshore CDF Post Dredge Monitoring Plan. It states that requirements were met as set forth in the RWQCB and USACE permits.

The GSU recommends this paragraph include the primary conclusions determined from the monitoring programs, specifically about the effectiveness of the CDF to prevent migration of contaminants into San Diego Bay or groundwater sources.</td><td>Response 1:
The RWQCB and USACE permits required the submittal of a postclosure water quality monitoring and CDF maintenance plan. The submittal of the Nearshore CDF Post Dredge Monitoring Plan satisfied this requirement. The evaluation of the effectiveness of the CDF in preventing migration of contaminants into San Diego Bay was deferred to the Focused RI/RFI which is scheduled for completion in 2003.

Please note the Section 6 indicates that the Focused RI/RFI is scheduled for completion in 2002. The report will be revised to indicate that the Focused RI/RFI is scheduled for completion in 2003.</td></tr>
</table>